FIG. 1

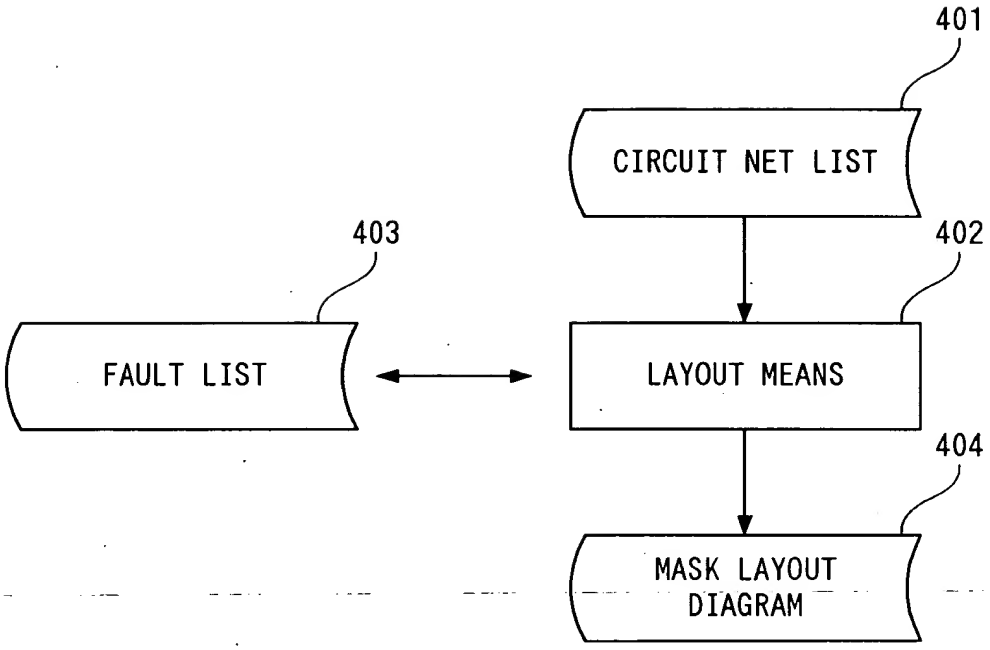

401
CIRCUIT NET LIST
403
402
FAULT LIST
LAYOUT MEANS
404
MASK LAYOUT DIAGRAM

FIG. 2

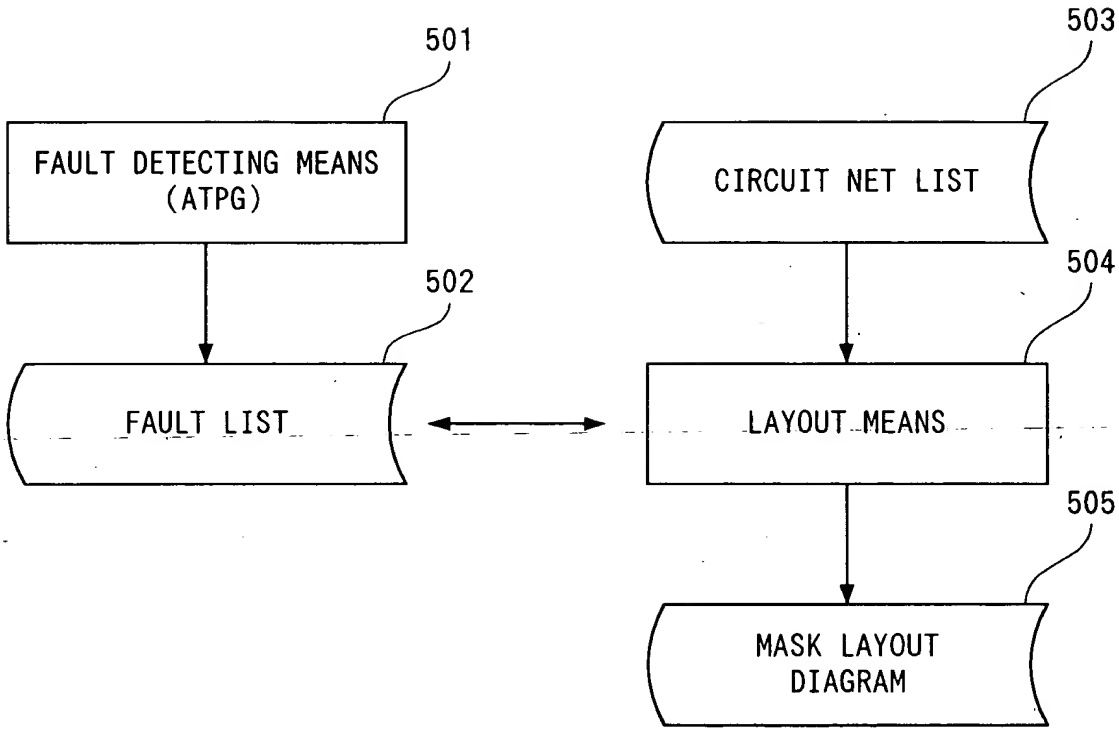

501
FAULT DETECTING MEANS
(ATPG)
502
FAULT LIST
503
CIRCUIT NET LIST
504
LAYOUT MEANS
505
MASK LAYOUT
DIAGRAM

FIG. 3

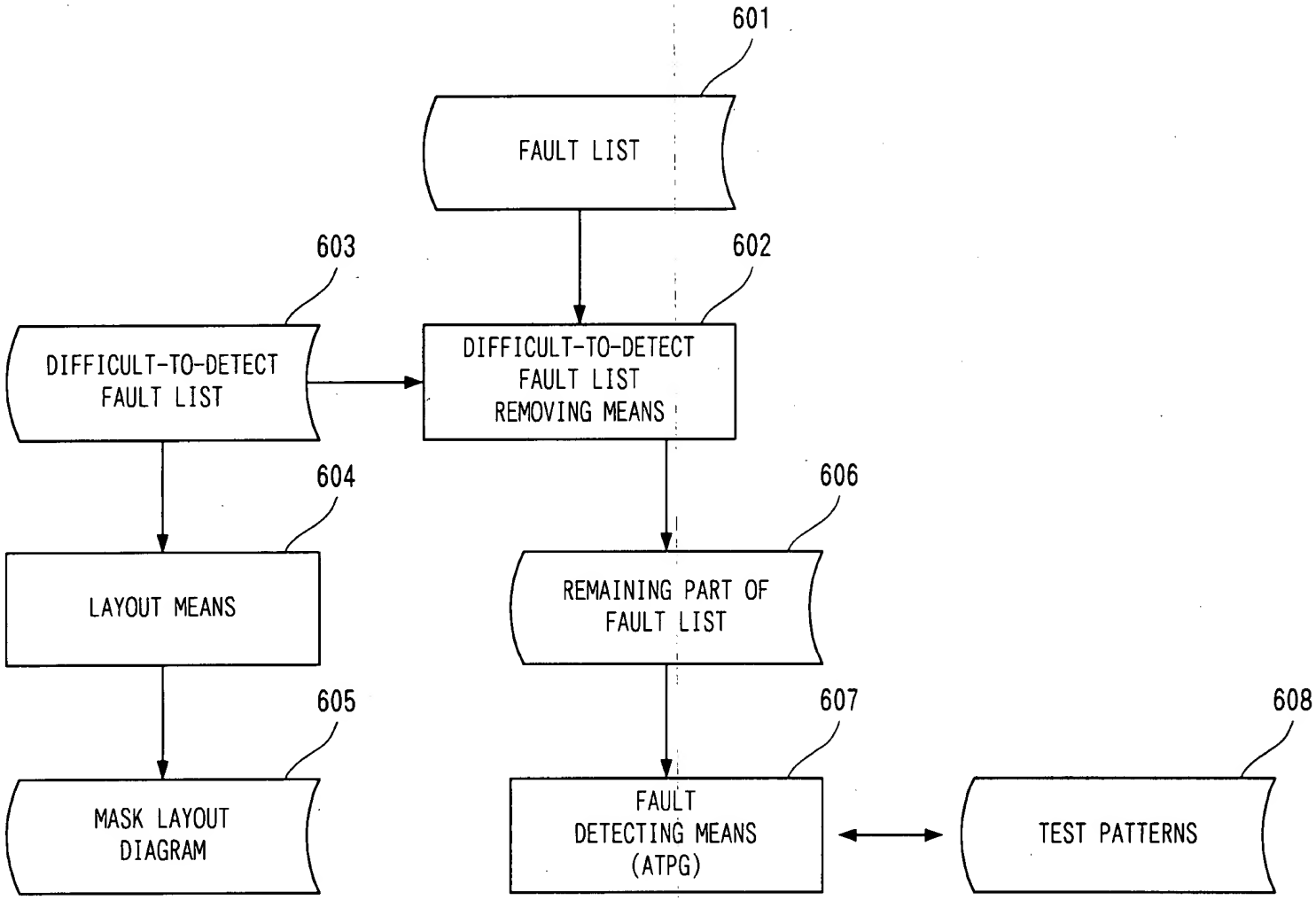

601
FAULT LIST
603
602
DIFFICULT-TO-DETECT FAULT LIST
DIFFICULT-TO-DETECT FAULT LIST REMOVING MEANS
604
606
LAYOUT MEANS
REMAINING PART OF FAULT LIST
605
607
608
MASK LAYOUT DIAGRAM
FAULT DETECTING MEANS (ATPG)
TEST PATTERNS

FIG. 4

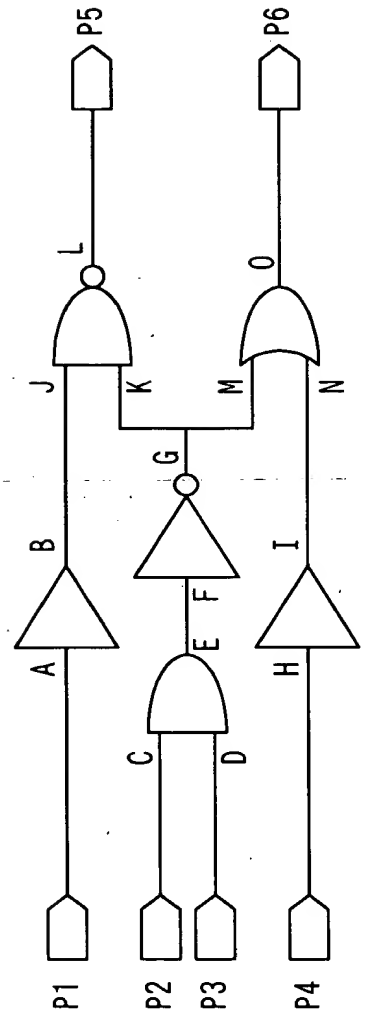


FIG. 5

TARGET FAULT
ONE FAULT AT POINT A
ZERO FAULT AT POINT A
ONE FAULT AT POINT B
ZERO FAULT AT POINT B
ONE FAULT AT POINT C
ZERO FAULT AT POINT C
. . . . .
ONE FAULT AT POINT N
ZERO FAULT AT POINT N
ONE FAULT AT POINT O
ZERO FAULT AT POINT O

FIG. 6

TARGET FAULT	LIKELIHOOD OF FAULT
ONE FAULT AT POINT H	LIKELY TO OCCUR
ONE FAULT AT POINT I	
ZERO FAULT AT POINT F	
ONE FAULT AT POINT G	
ONE FAULT AT POINT M	
ONE FAULT AT POINT O	
. . . . .	
ZERO FAULT AT POINT K	
ONE FAULT AT POINT L	UNLIKELY TO OCCUR

FIG. 7

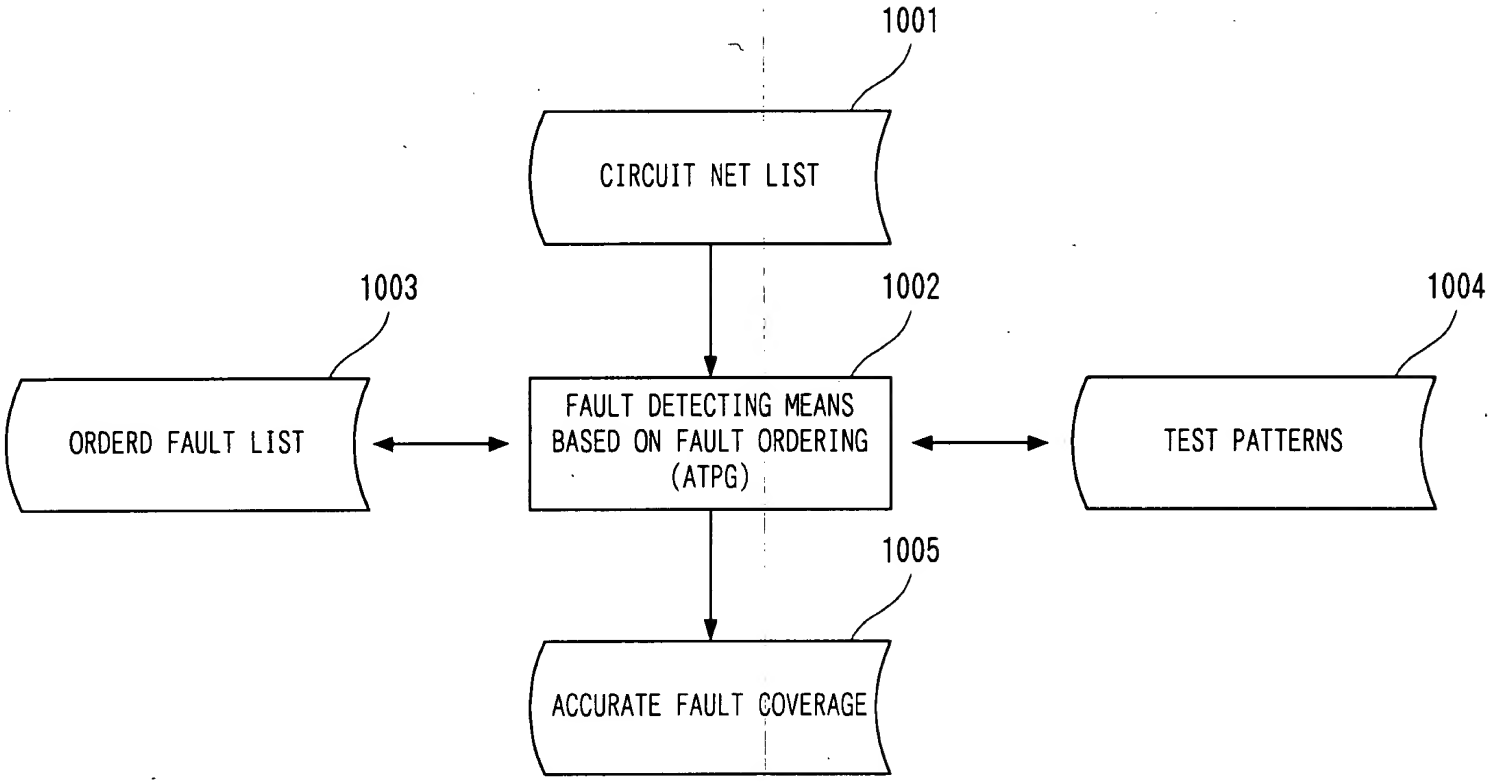

1001
CIRCUIT NET LIST
1003
1002
1004
ORDERD FAULT LIST
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
TEST PATTERNS
1005
ACCURATE FAULT COVERAGE

FIG. 8

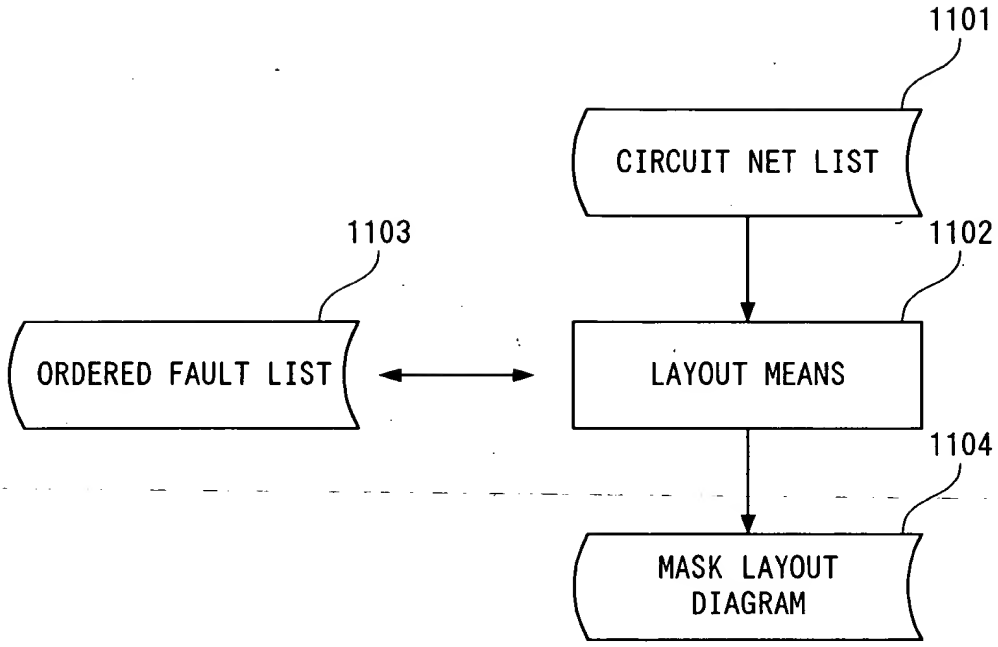

1101
CIRCUIT NET LIST
1103
1102
ORDERED FAULT LIST
LAYOUT MEANS
1104
MASK LAYOUT DIAGRAM

FIG. 9

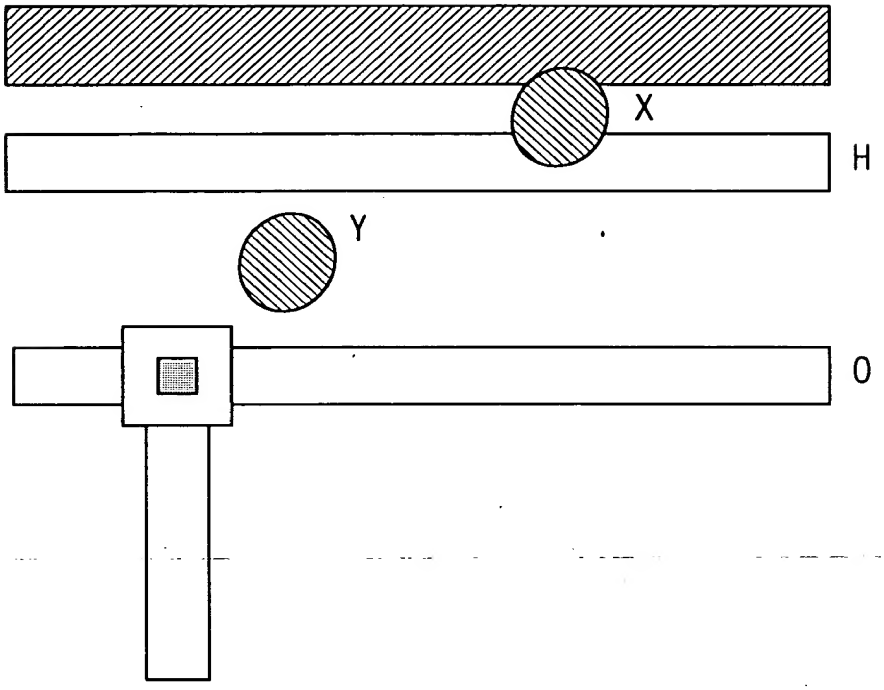


FIG. 10

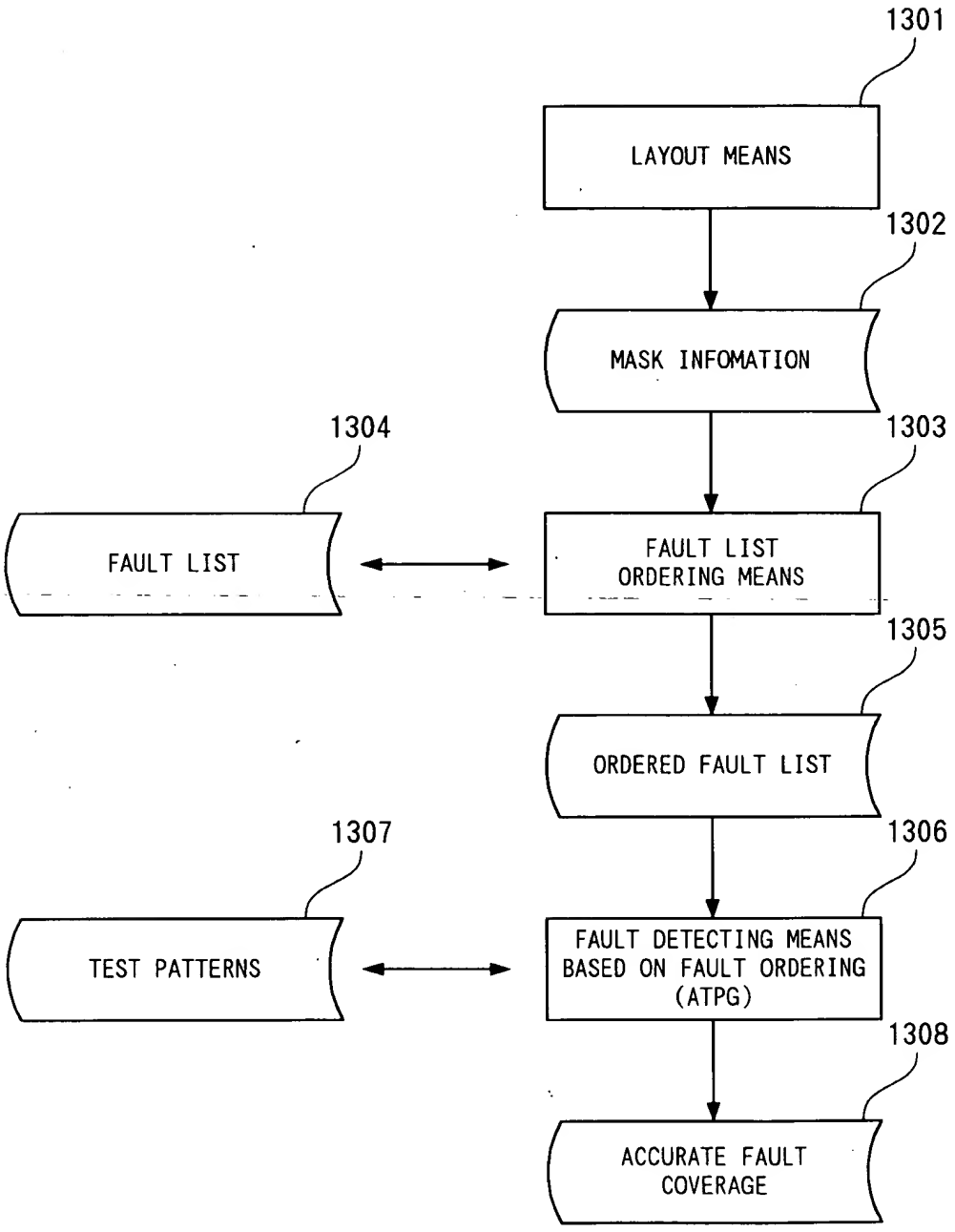

1301
LAYOUT MEANS
1302
MASK INFOMATION
1304
1303
FAULT LIST
FAULT LIST ORDERING MEANS
1305
ORDERED FAULT LIST
1307
1306
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
1308
ACCURATE FAULT COVERAGE

FIG. 11

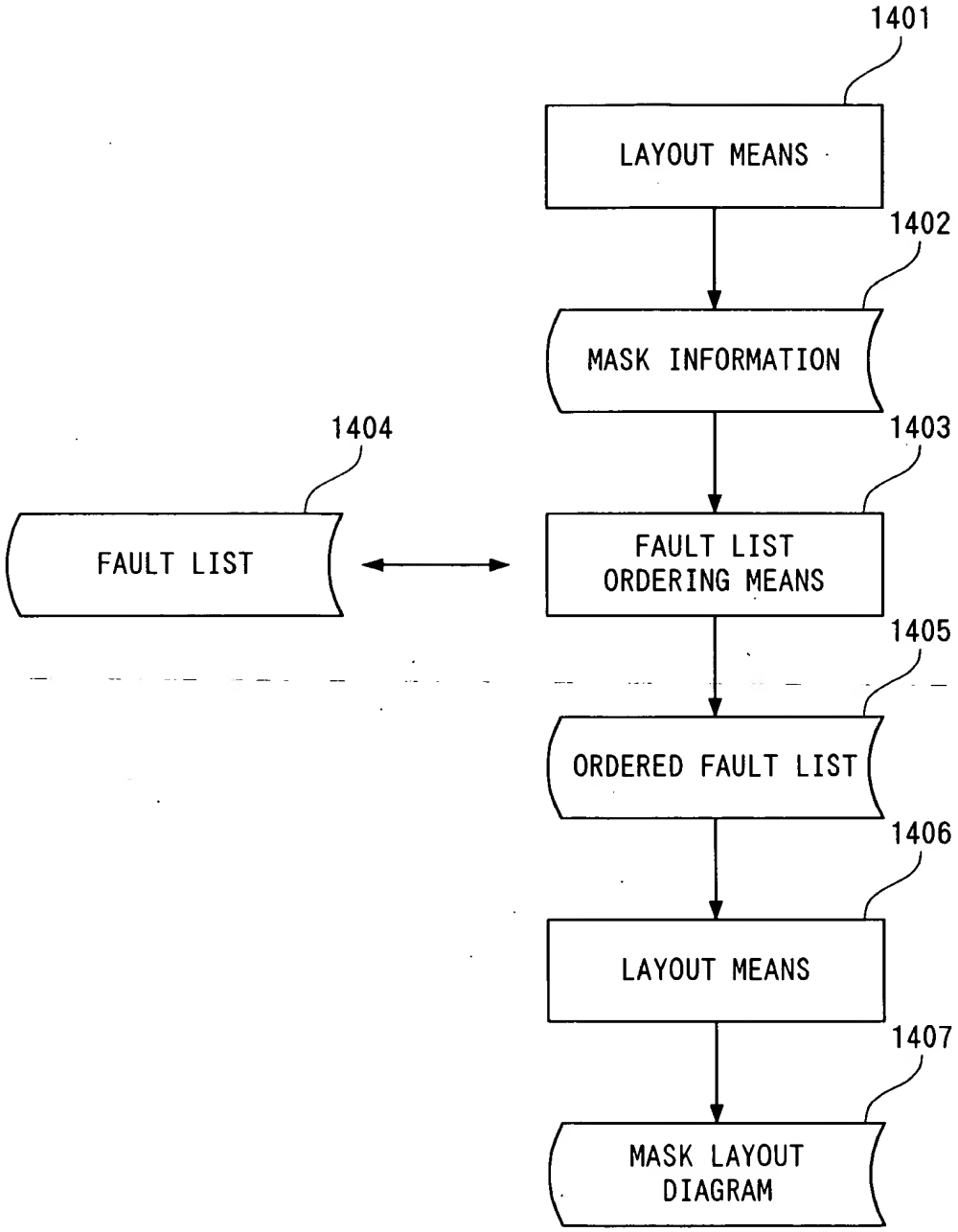

1401
LAYOUT MEANS
1402
MASK INFORMATION
1404
1403
FAULT LIST
FAULT LIST ORDERING MEANS
1405
ORDERED FAULT LIST
1406
LAYOUT MEANS
1407
MASK LAYOUT DIAGRAM

FIG. 12

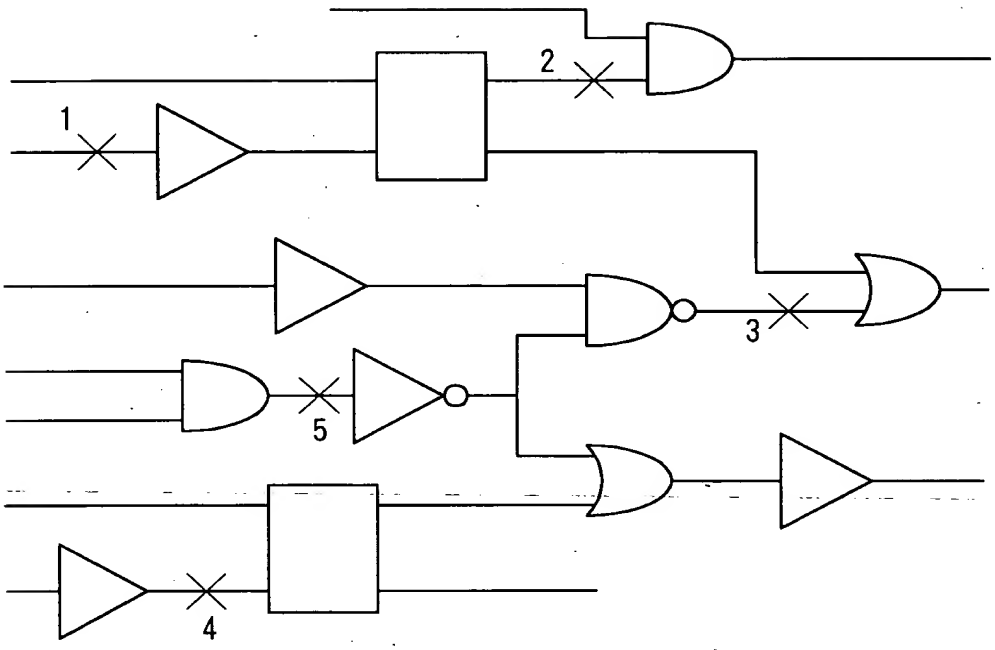


FIG. 13

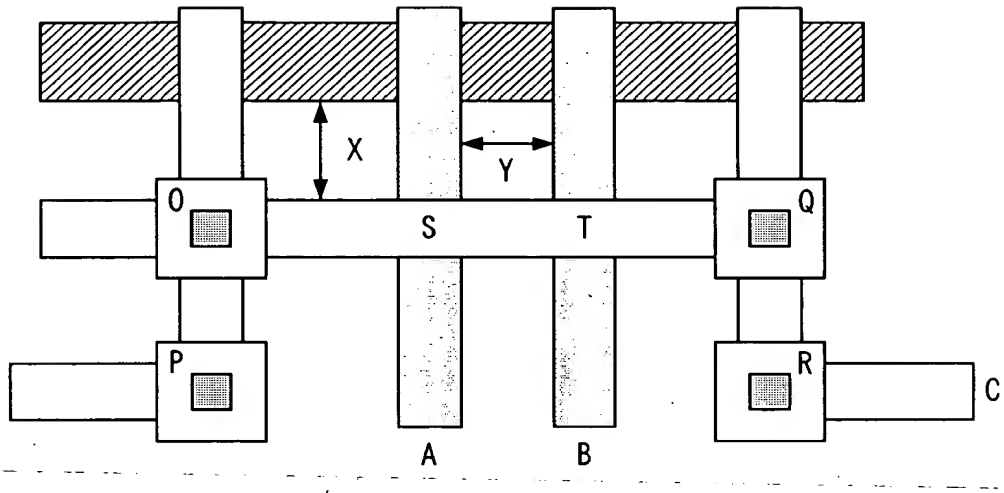


FIG. 14

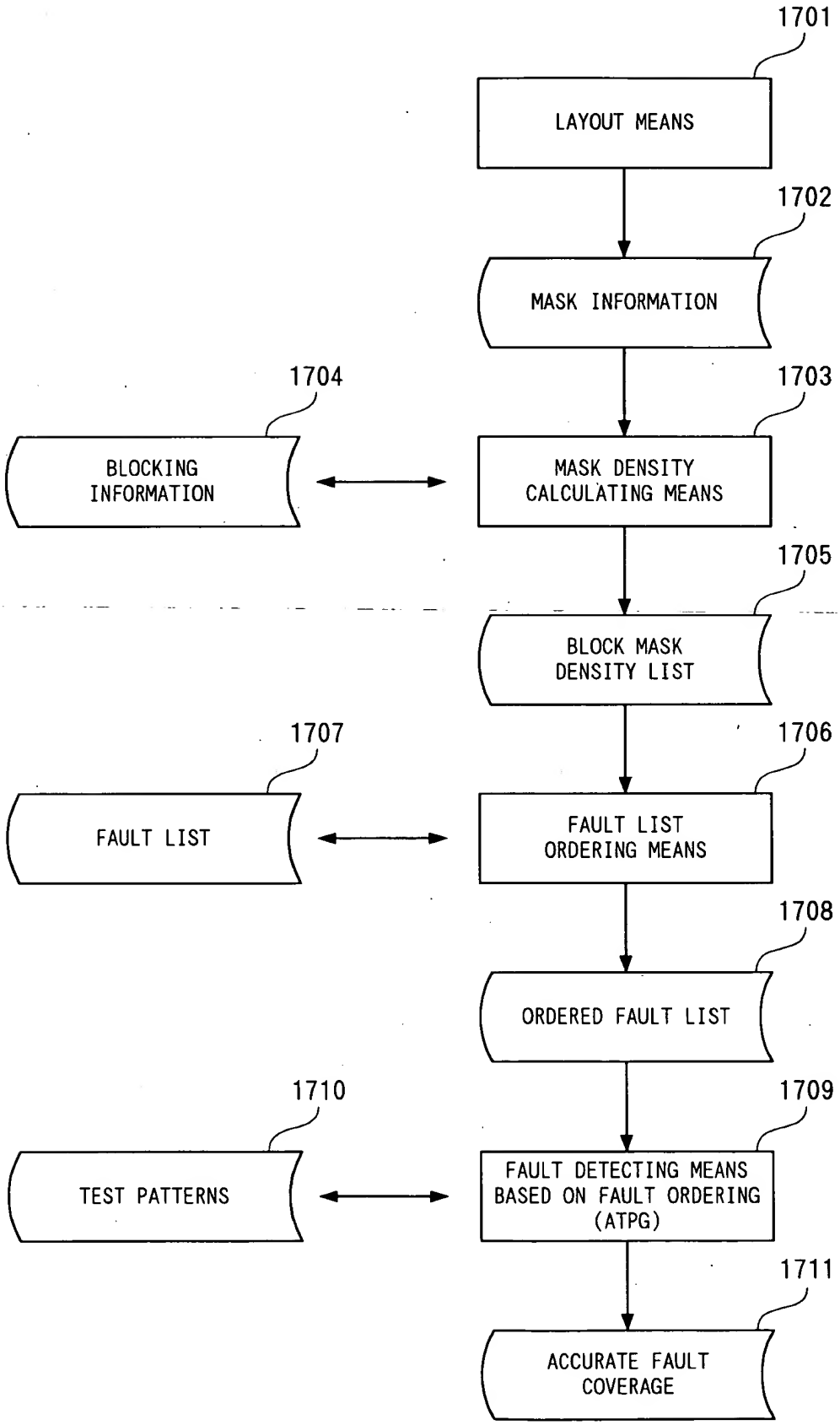

1701
LAYOUT MEANS
1702
MASK INFORMATION
1704
BLOCKING INFORMATION
1703
MASK DENSITY CALCULATING MEANS
1705
BLOCK MASK DENSITY LIST
1707
FAULT LIST
1706
FAULT LIST ORDERING MEANS
1708
ORDERED FAULT LIST
1710
TEST PATTERNS
1709
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
1711
ACCURATE FAULT COVERAGE

FIG. 15

CELL/BLOCK NAME	MASK DENSITY
BLOCK 1	90%
BLOCK 2	85%
BLOCK 3	91%
.	.
.	.
.	.
.	.
.	.
.	.
.	.

FIG. 16

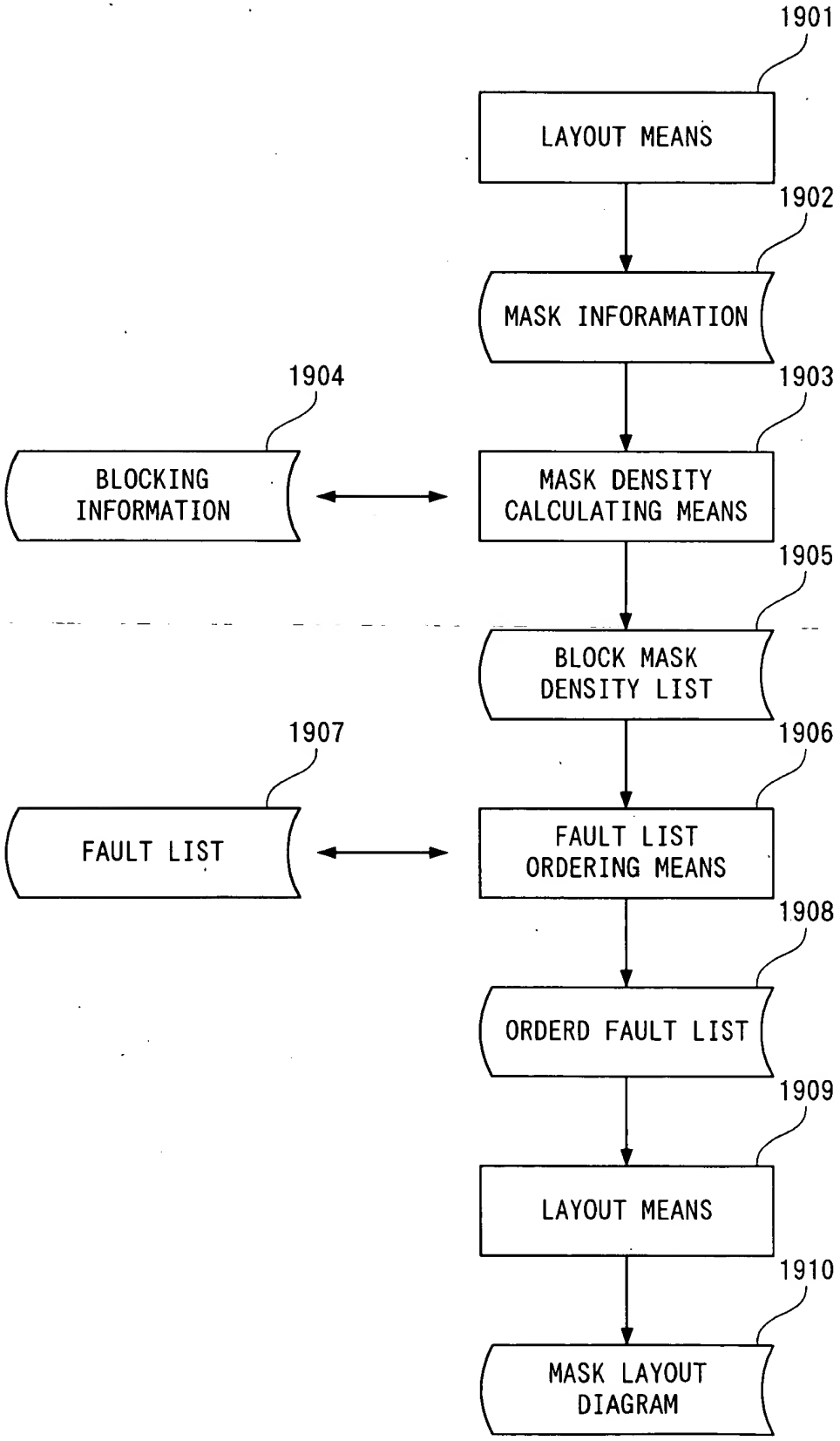

1901
LAYOUT MEANS
1902
MASK INFORAMATION
1904
1903
BLOCKING INFORMATION
MASK DENSITY CALCULATING MEANS
1905
BLOCK MASK DENSITY LIST
1907
1906
FAULT LIST
FAULT LIST ORDERING MEANS
1908
ORDERD FAULT LIST
1909
LAYOUT MEANS
1910
MASK LAYOUT DIAGRAM

FIG. 17

CELL /FUNCTIONAL BLOCK NAME	NUMBER OF PAST OPERATIONS	NUMBER OF PAST DEFECTS	RELIABILITY TEST STATUS	NUMBER OF SUCCESSFUL PROCESSES
BLOCK A	1500	0	◎	100
BLOCK B	500	2	◎	100
BLOCK C	800	1	○	100
BLOCK D	20	3	△	5
BLOCK E	1000	0	◎	100
BLOCK F	1201	0	◎	100
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

FIG. 18

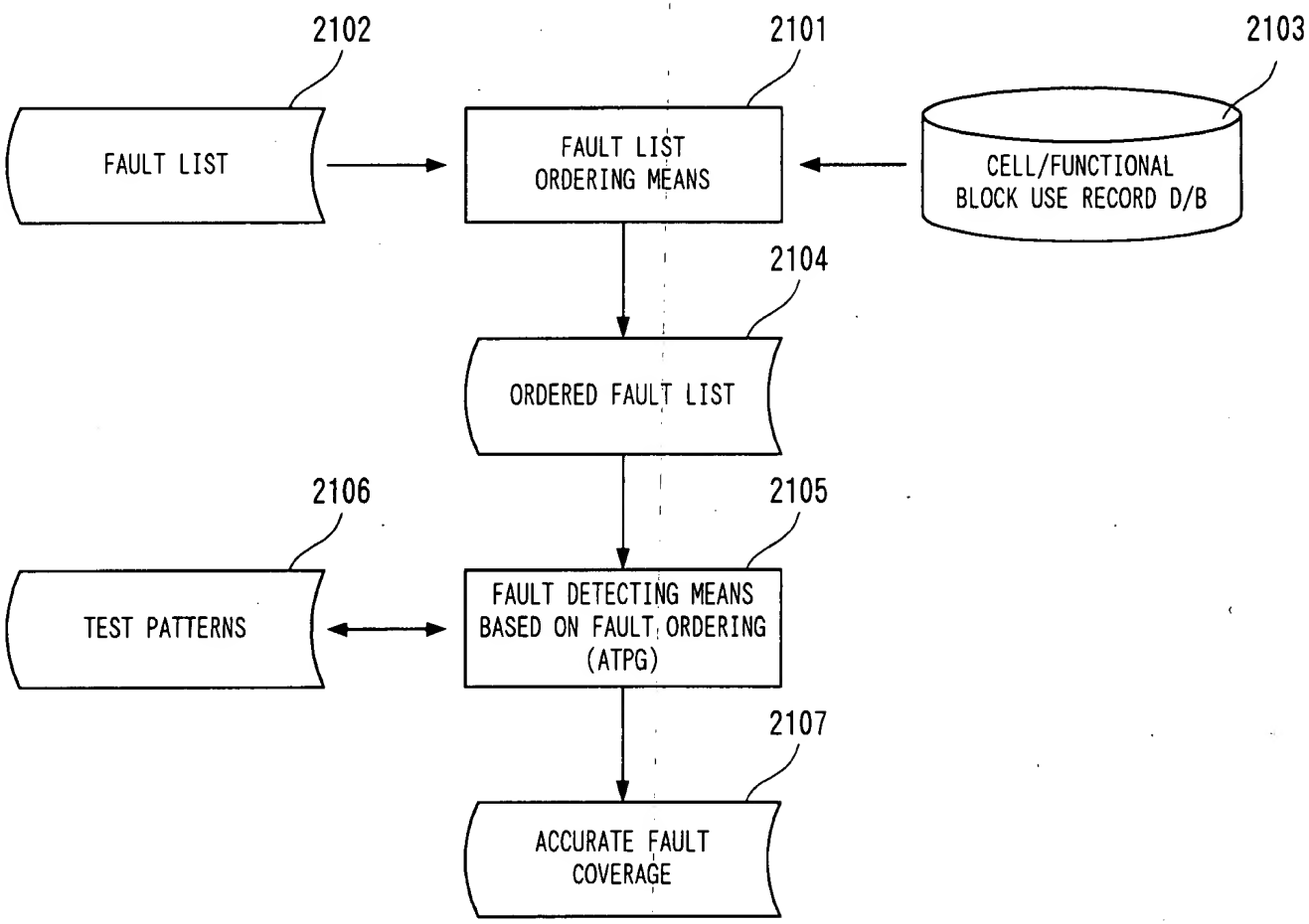

2102
2101
2103
FAULT LIST
FAULT LIST ORDERING MEANS
CELL/FUNCTIONAL BLOCK USE RECORD D/B
2104
ORDERED FAULT LIST
2106
2105
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
2107
ACCURATE FAULT COVERAGE

FIG. 19

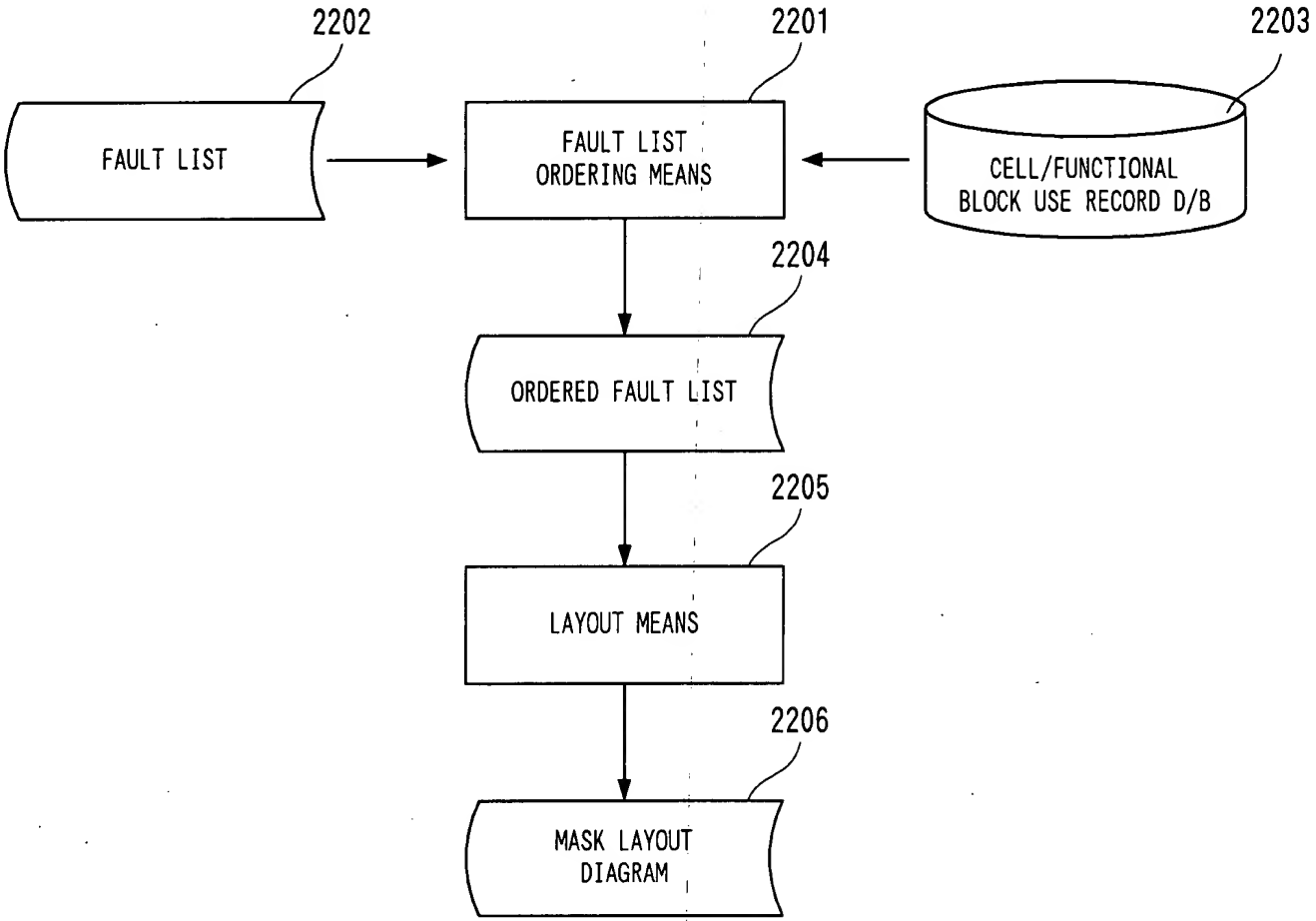

2202
2201
2203
FAULT LIST
FAULT LIST ORDERING MEANS
CELL/FUNCTIONAL BLOCK USE RECORD D/B
2204
ORDERED FAULT LIST
2205
LAYOUT MEANS
2206
MASK LAYOUT DIAGRAM

FIG. 20

TARGET FAULT	CONVENTIONAL FAULT WEIGHTING	WEIGHTING BASED ON FAULT LIKELIHOOD
ONE FAULT AT POINT A	1	0.2
ZERO FAULT AT POINT A	1	0.2
ONE FAULT AT POINT B	1	1.8
ZERO FAULT AT POINT B	1	1.6
ONE FAULT AT POINT C	1	0.5
ZERO FAULT AT POINT C	1	0.5
. . . . .	.	.
. . . . .	.	.
ONE FAULT AT POINT T	1	1.0
ZERO FAULT AT POINT T	1	1.0

FIG. 21

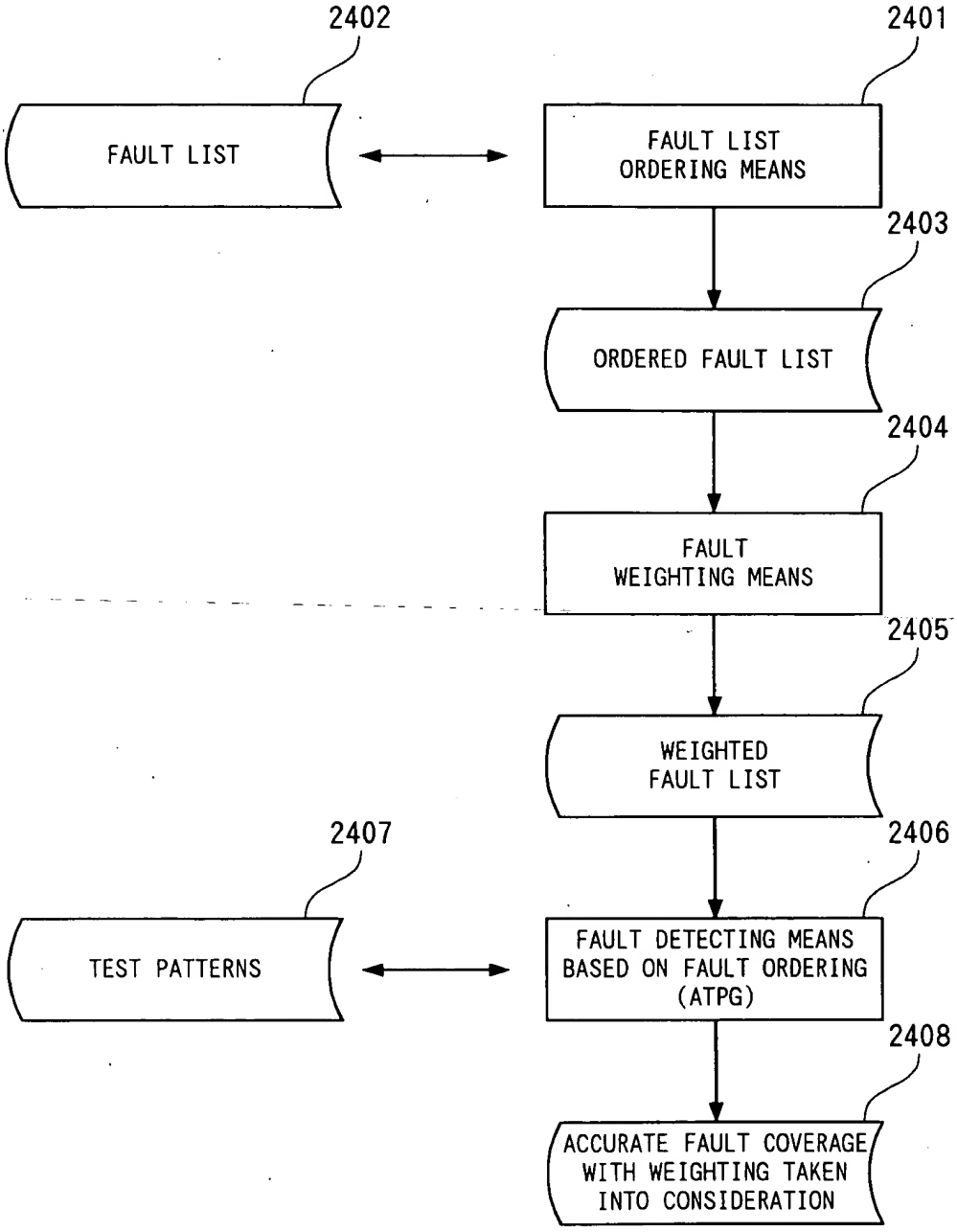

2402
2401
FAULT LIST
FAULT LIST ORDERING MEANS
2403
ORDERED FAULT LIST
2404
FAULT WEIGHTING MEANS
2405
WEIGHTED FAULT LIST
2407
2406
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
2408
ACCURATE FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 22

TARGET FAULT	WEIGHTING
ONE FAULT AT POINT H	1.95
ONE FAULT AT POINT I	1.90
ZERO FAULT AT POINT F	1.85
ONE FAULT AT POINT G	1.80
. . . . .	. . . . .
ZERO FAULT AT POINT S	1.05
ZERO FAULT AT POINT T	1.00
ZERO FAULT AT POINT B	0.95
. . . . .	. . . . .
ZERO FAULT AT POINT K	0.10
ONE FAULT AT POINT L	0.05

FIG. 23

TARGET FAULT	WEIGHTING	DETECTED/ UNDERECTED DETERMINATION
ONE FAULT AT POINT H	1.95	DETECTED
ONE FAULT AT POINT I	1.90	DETECTED
ZERO FAULT AT POINT F	1.85	UNDETECTED
ONE FAULT AT POINT G	1.80	DETECTED
. . . . .	. . .	. . . . .
ZERO FAULT AT POINT S	1.05	UNDETECTED
ZERO FAULT AT POINT T	1.00	DETECTED
ZERO FAULT AT POINT B	0.95	UNDETECTED
. . . . .	. . .	. . . . .
ZERO FAULT AT POINT K	0.10	UNDETECTED
ONE FAULT AT POINT L	0.05	DETECTED

FIG. 24

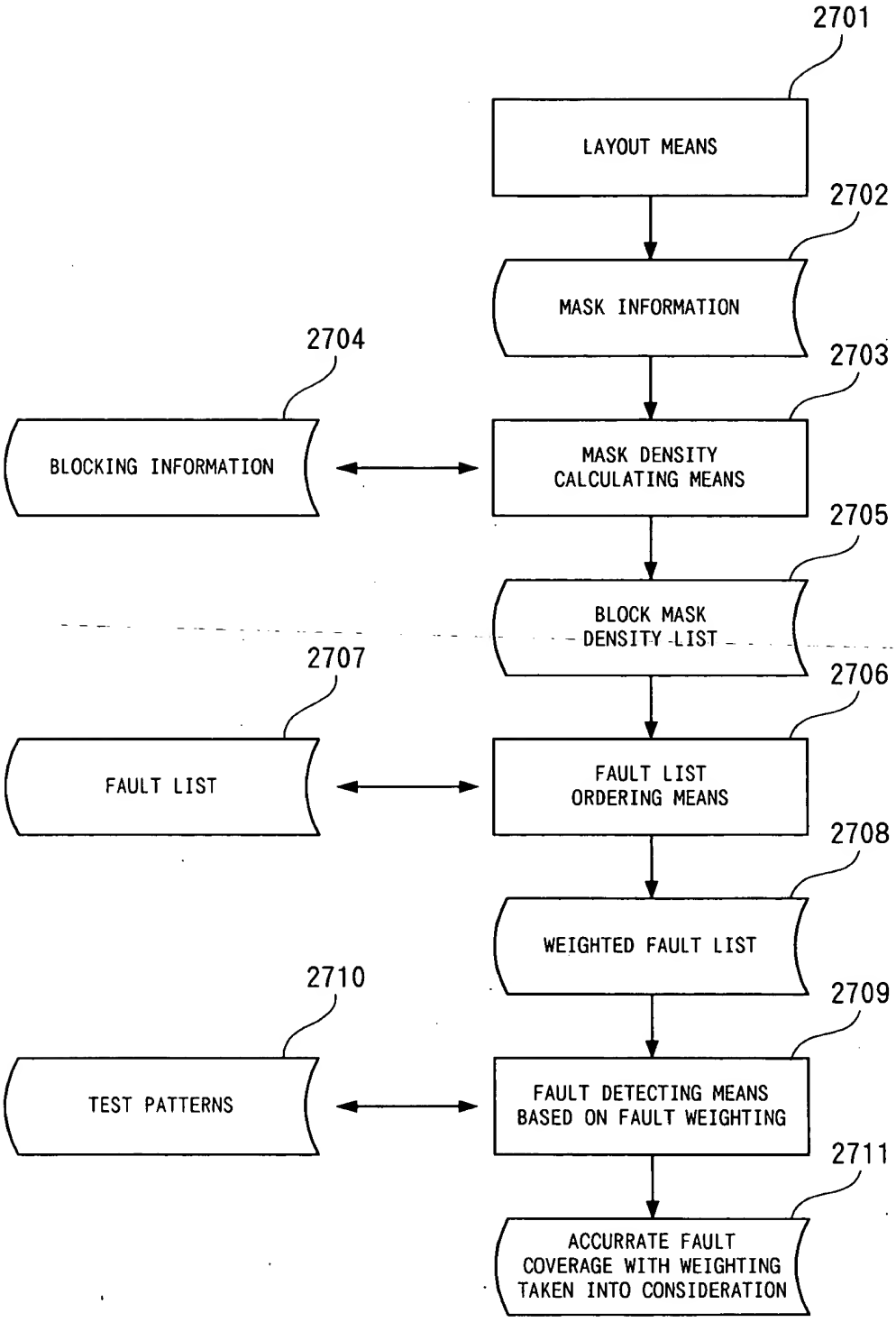

2701
LAYOUT MEANS
2702
MASK INFORMATION
2704
2703
BLOCKING INFORMATION
MASK DENSITY CALCULATING MEANS
2705
BLOCK MASK DENSITY LIST
2707
2706
FAULT LIST
FAULT LIST ORDERING MEANS
2708
WEIGHTED FAULT LIST
2710
2709
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT WEIGHTING
2711
ACCURRATE FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 25

TARGET FAULT	CELL/ FUNCTIONAL BLOCK	MASK DENSITY	WEIGHTING
	1 CHIP	1.0	
A	BLOCK A	0.9	0.9
B	BLOCK B	0.9	0.9
C	BLOCK C	0.95	0.95
D	BLOCK D	0.95	0.95
E	BLOCK E	0.95	0.95
F	BLOCK F	0.8	0.8

FIG. 26

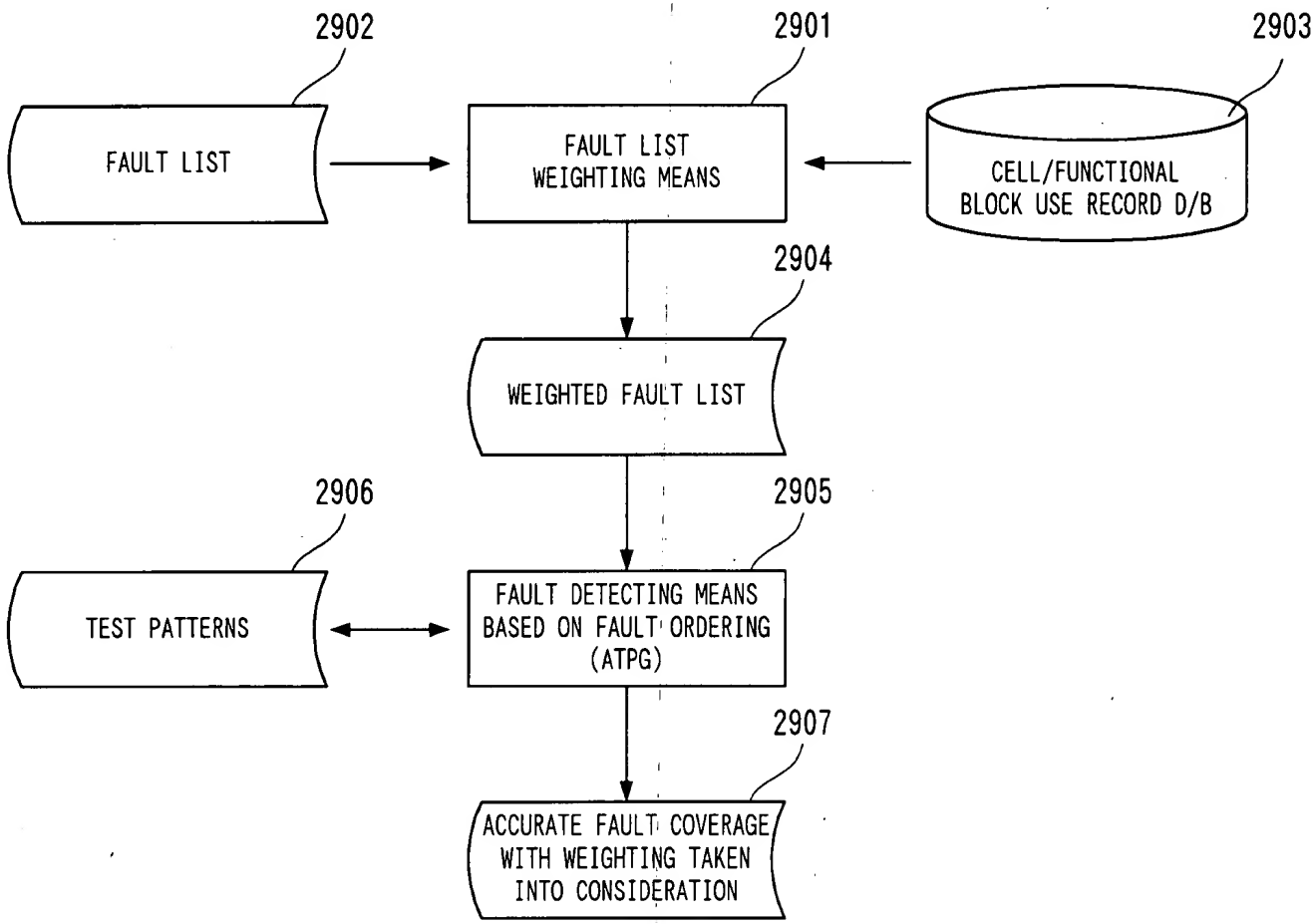

2902
2901
2903
FAULT LIST
FAULT LIST WEIGHTING MEANS
CELL/FUNCTIONAL BLOCK USE RECORD D/B
2904
WEIGHTED FAULT LIST
2906
2905
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT ORDERING (ATPG)
2907
ACCURATE FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 27

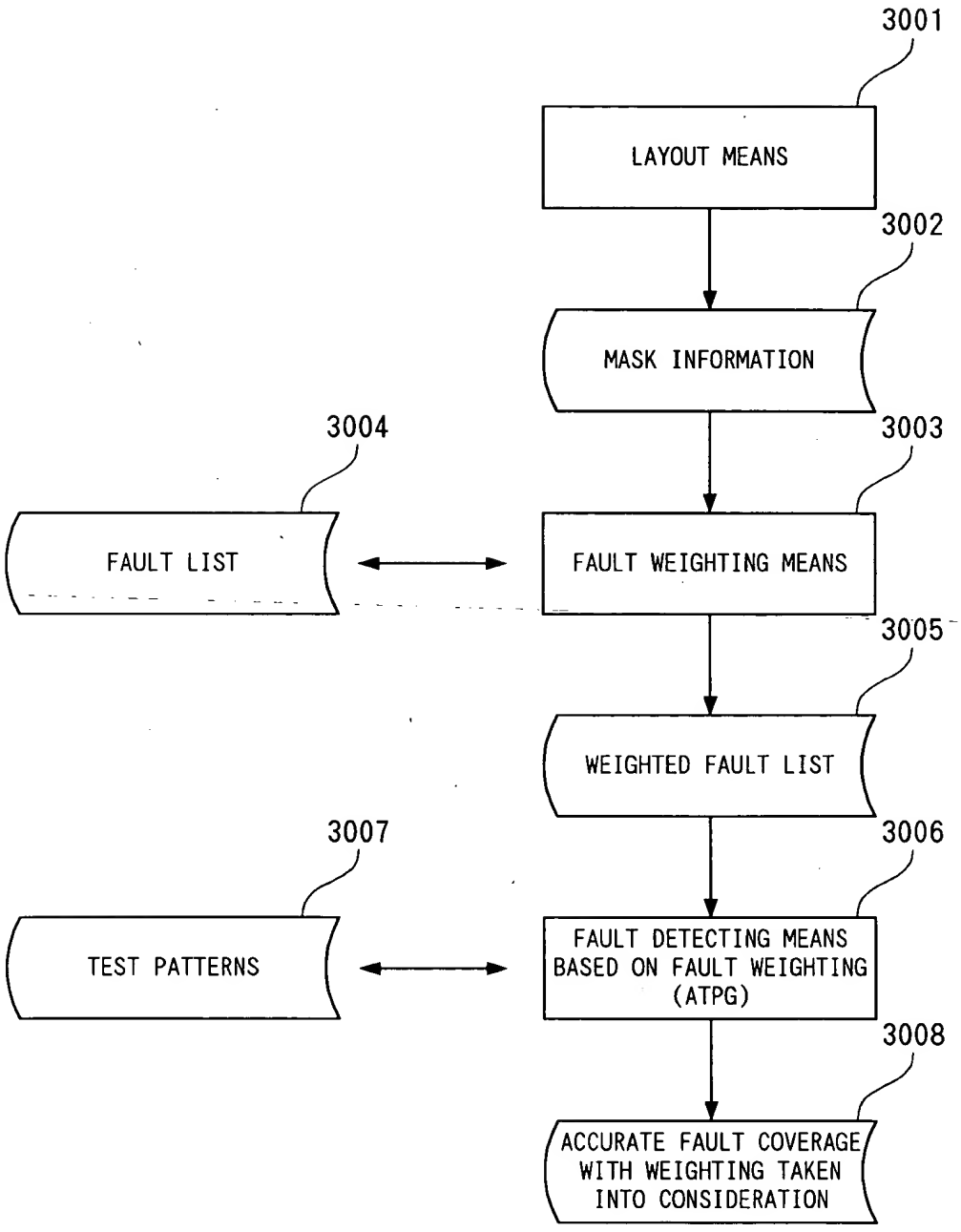

3001
LAYOUT MEANS
3002
MASK INFORMATION
3004
3003
FAULT LIST
FAULT WEIGHTING MEANS
3005
WEIGHTED FAULT LIST
3007
3006
TEST PATTERNS
FAULT DETECTING MEANS BASED ON FAULT WEIGHTING (ATPG)
3008
ACCURATE FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 28

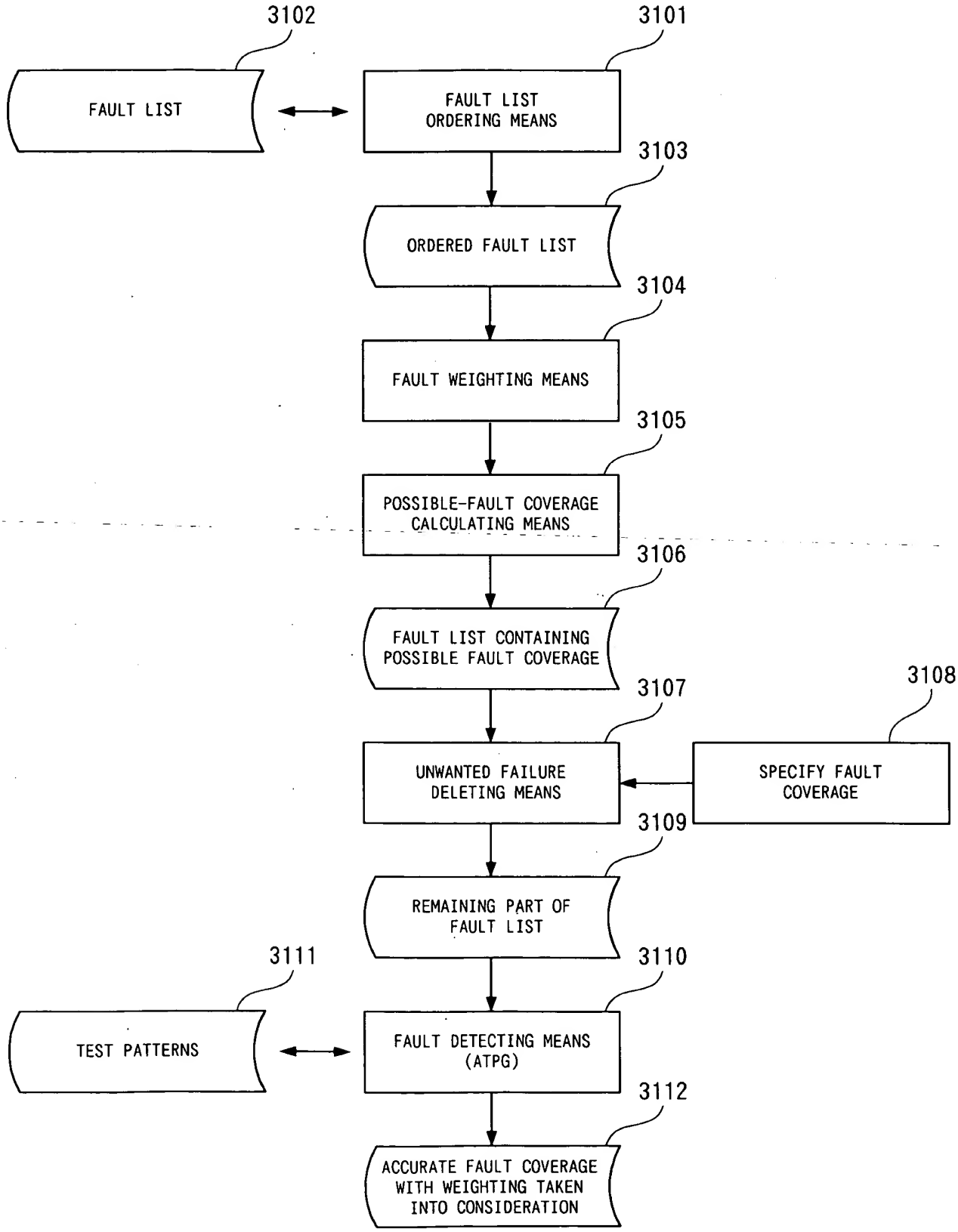

3102
3101
FAULT LIST
FAULT LIST ORDERING MEANS
3103
ORDERED FAULT LIST
3104
FAULT WEIGHTING MEANS
3105
POSSIBLE-FAULT COVERAGE CALCULATING MEANS
3106
FAULT LIST CONTAINING POSSIBLE FAULT COVERAGE
3108
3107
UNWANTED FAILURE DELETING MEANS
SPECIFY FAULT COVERAGE
3109
REMAINING PART OF FAULT LIST
3111
3110
TEST PATTERNS
FAULT DETECTING MEANS (ATPG)
3112
ACCURATE FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 29

TARGET FAULT	WEIGHTING	ACCUMULATED POSSIBLE FAULT COVERAGE
ONE FAULT AT POINT H	1.95	5.0%
ONE FAULT AT POINT I	1.90	9.9%
ZERO FAULT AT POINT F	1.85	14.6%
ONE FAULT AT POINT G	1.80	19.2%
. . . . .	. . .	. . . . .
ZERO FAULT AT POINT K	0.10	99.9%
ONE FAULT AT POINT L	0.05	100%

FIG. 30

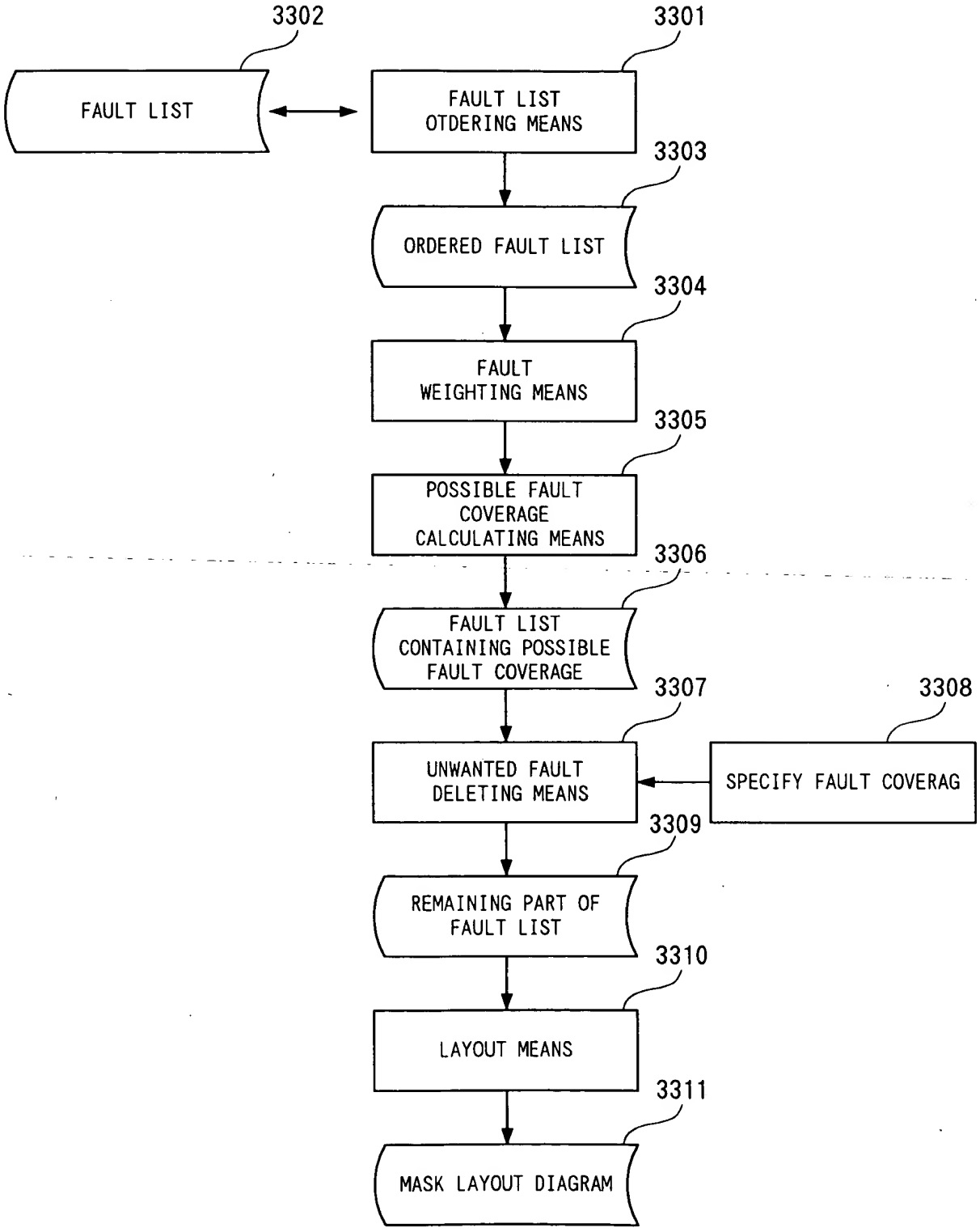

3302
3301
FAULT LIST
FAULT LIST OTDERING MEANS
3303
ORDERED FAULT LIST
3304
FAULT WEIGHTING MEANS
3305
POSSIBLE FAULT COVERAGE CALCULATING MEANS
3306
FAULT LIST CONTAINING POSSIBLE FAULT COVERAGE
3307
3308
UNWANTED FAULT DELETING MEANS
SPECIFY FAULT COVERAG
3309
REMAINING PART OF FAULT LIST
3310
LAYOUT MEANS
3311
MASK LAYOUT DIAGRAM

FIG. 31

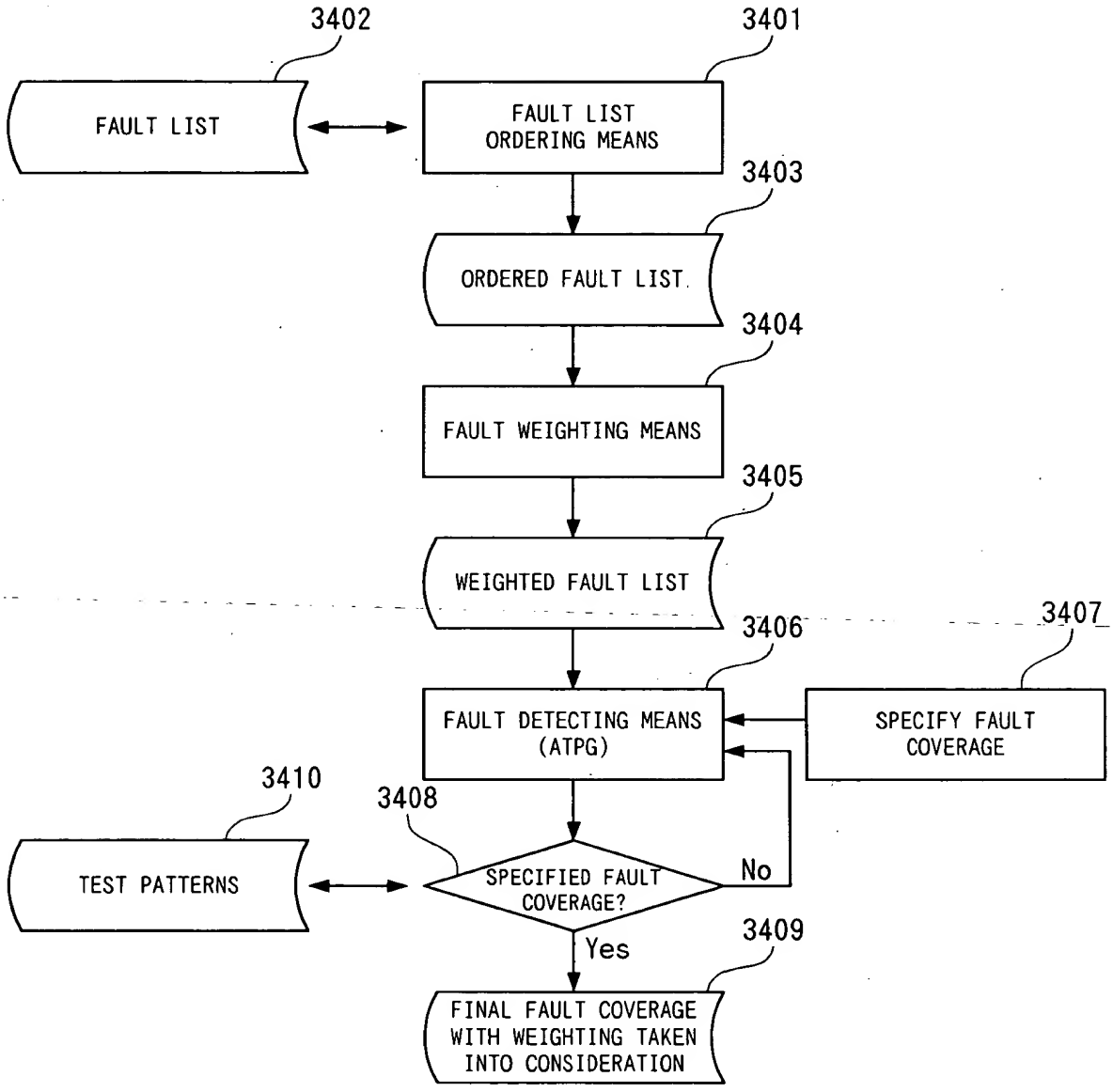

3402
3401
FAULT LIST
FAULT LIST ORDERING MEANS
3403
ORDERED FAULT LIST
3404
FAULT WEIGHTING MEANS
3405
WEIGHTED FAULT LIST
3406
3407
FAULT DETECTING MEANS (ATPG)
SPECIFY FAULT COVERAGE
3410
3408
TEST PATTERNS
SPECIFIED FAULT COVERAGE?
No
Yes
3409
FINAL FAULT COVERAGE WITH WEIGHTING TAKEN INTO CONSIDERATION

FIG. 32

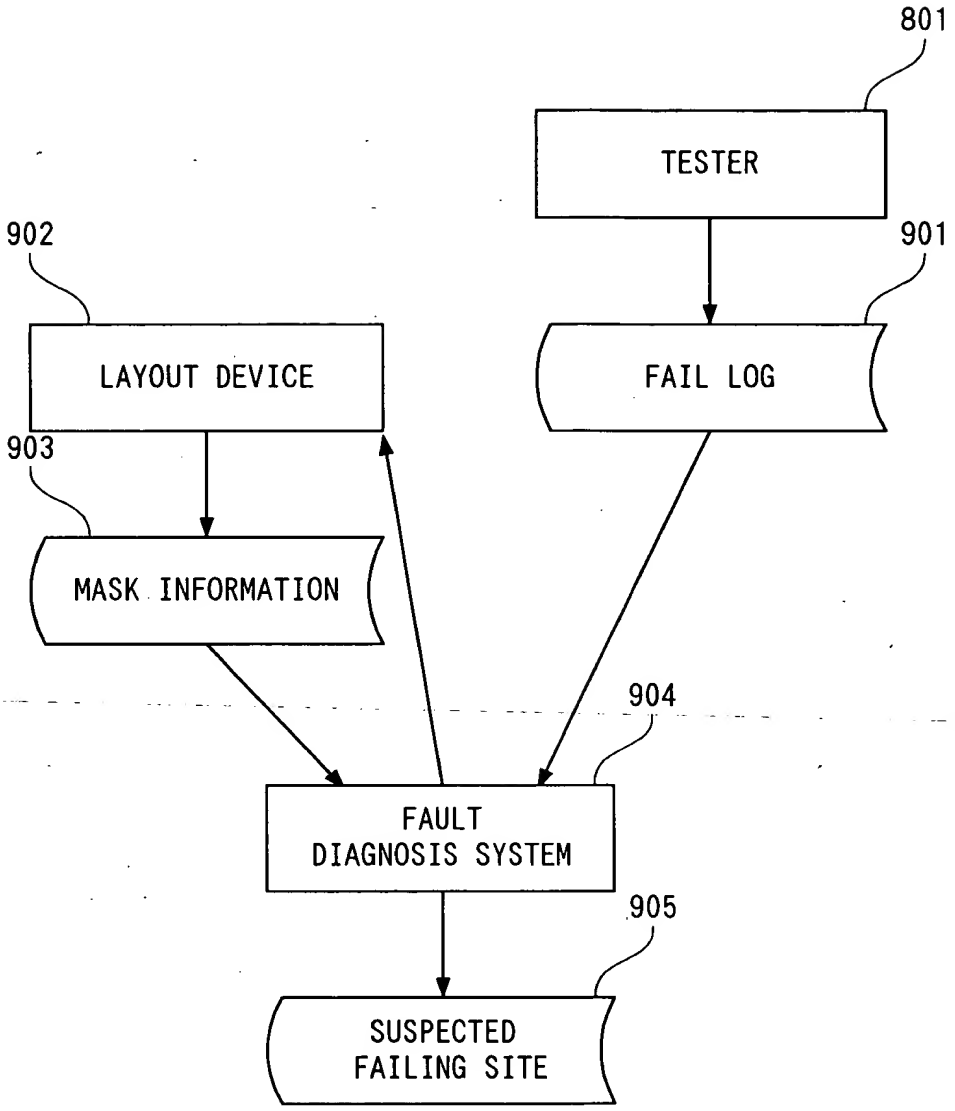

801
TESTER
902
901
LAYOUT DEVICE
FAIL LOG
903
MASK INFORMATION
904
FAULT
DIAGNOSIS SYSTEM
905
SUSPECTED
FAILING SITE

FIG. 33

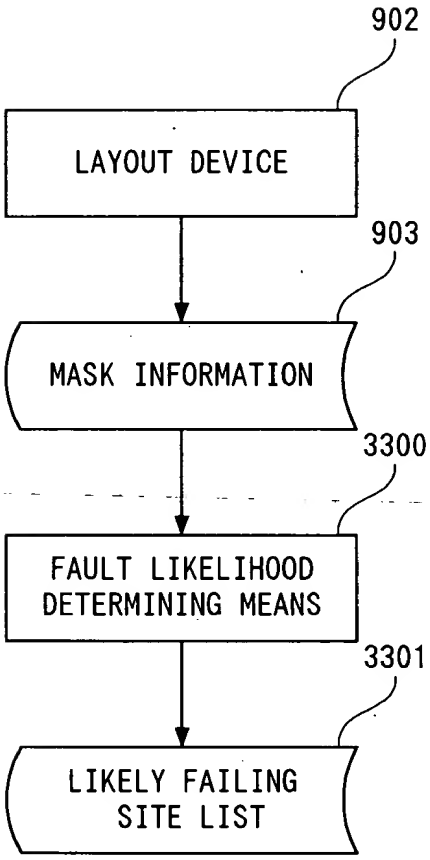

902
LAYOUT DEVICE
903
MASK INFORMATION
3300
FAULT LIKELIHOOD DETERMINING MEANS
3301
LIKELY FAILING SITE LIST

FIG. 34

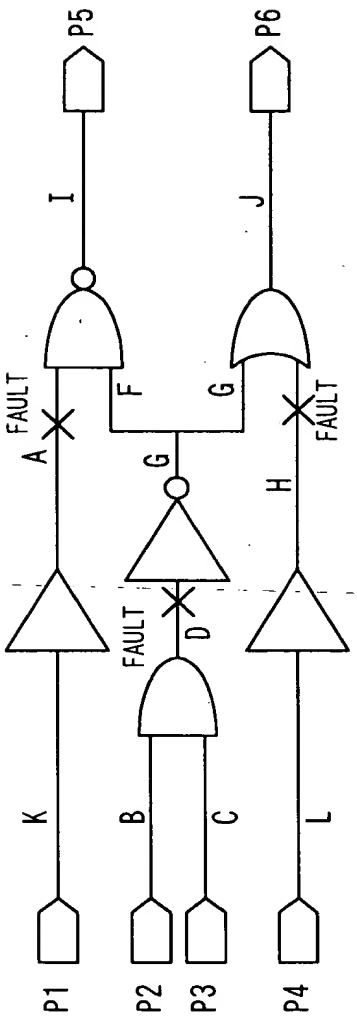


FIG. 35

TIME	TEST PATTERN					
	INPUT				EXPECTED VALUE	
	P1	P2	P3	P4	P5	P6
1	0	0	1	0	H	H
2	1	0	1	1	L	H
3	0	1	1	0	H	L
4	1	1	0	1	L	H
5	1	1	1	1	H	H

FIG. 36

TIME	TEST PATTERN					
	INPUT				EXPECTED VALUE	
	P1	P2	P3	P4	P5	P6
1	0	0	1	0	(L)	H
2	1	0	1	1	L	H
3	0	1	1	0	H	L
4	1	1	0	1	L	H
5	1	1	1	1	H	H

FIG. 37

TIME	TEST PATTERN					
	INPUT				EXPECTED VALUE	
	P1	P2	P3	P4	P5	P6
1	0	0	1	0	(L)	H
2	1	0	1	1	L	H
3	0	1	1	0	H	(H)
4	1	1	0	1	L	H
5	1	1	1	1	H	H

FIG. 38

TIME	TEST PATTERN					
	INPUT				EXPECTED VALUE	
	P1	P2	P3	P4	P5	P6
1	0	0	1	0	H	H
2	1	0	1	1	(H)	H
3	0	1	1	0	H	(H)
4	1	1	0	1	(H)	H
5	1	1	1	1	H	H

FIG. 39

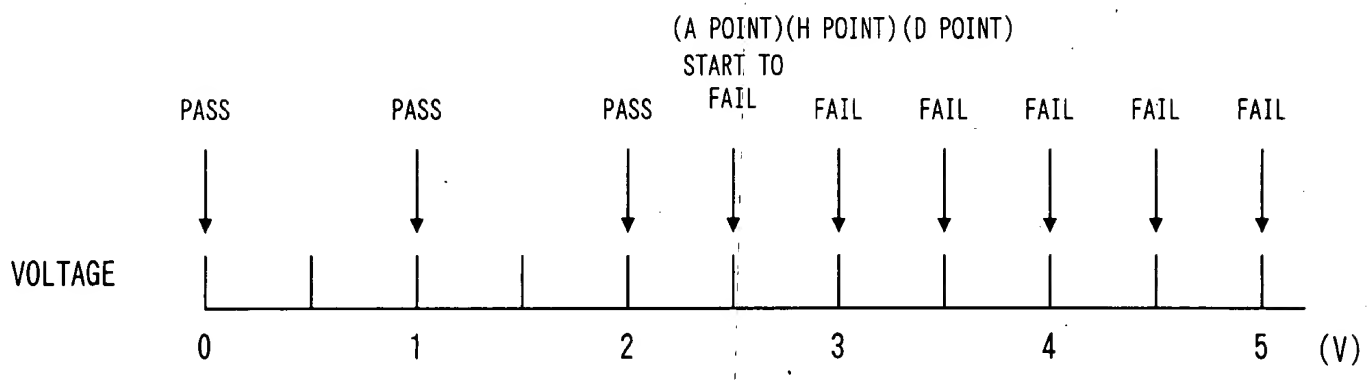

(A POINT)(H POINT)(D POINT)
START TO FAIL
PASS
PASS
PASS
FAIL
FAIL
FAIL
FAIL
FAIL
VOLTAGE
0
1
2
3
4
5
(V)

FIG. 40

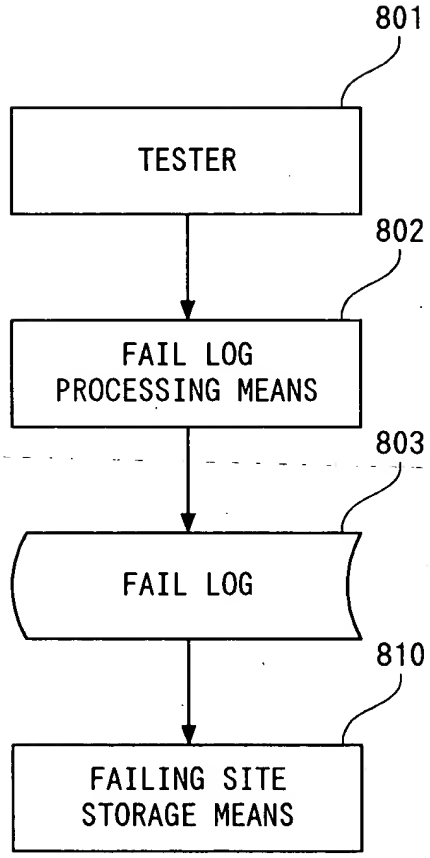

801
TESTER
802
FAIL LOG
PROCESSING MEANS
803
FAIL LOG
810
FAILING SITE
STORAGE MEANS

FIG. 41

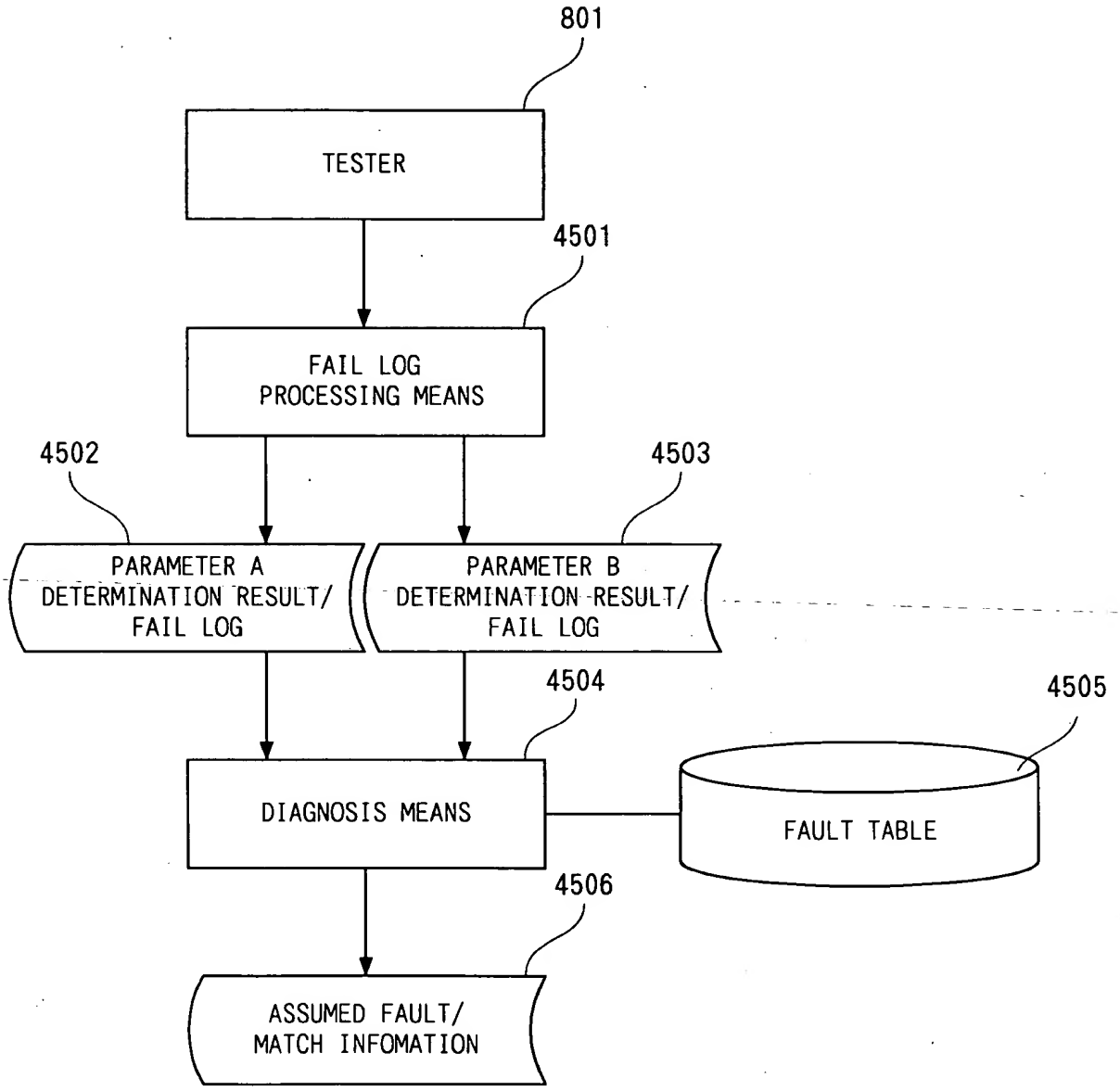

801
TESTER
4501
FAIL LOG
PROCESSING MEANS
4502
4503
PARAMETER A
DETERMINATION RESULT/
FAIL LOG
PARAMETER B
DETERMINATION RESULT/
FAIL LOG
4504
4505
DIAGNOSIS MEANS
FAULT TABLE
4506
ASSUMED FAULT/
MATCH INFOMATION

FIG. 42

PARAMETER	LIKELY FAULT
A&B	X FAULT
A&C	Y FAULT
B&C	Z FAULT
A&!B	α FAULT
A&!C	β FAULT
. . . . .	. . . . .

FIG. 43

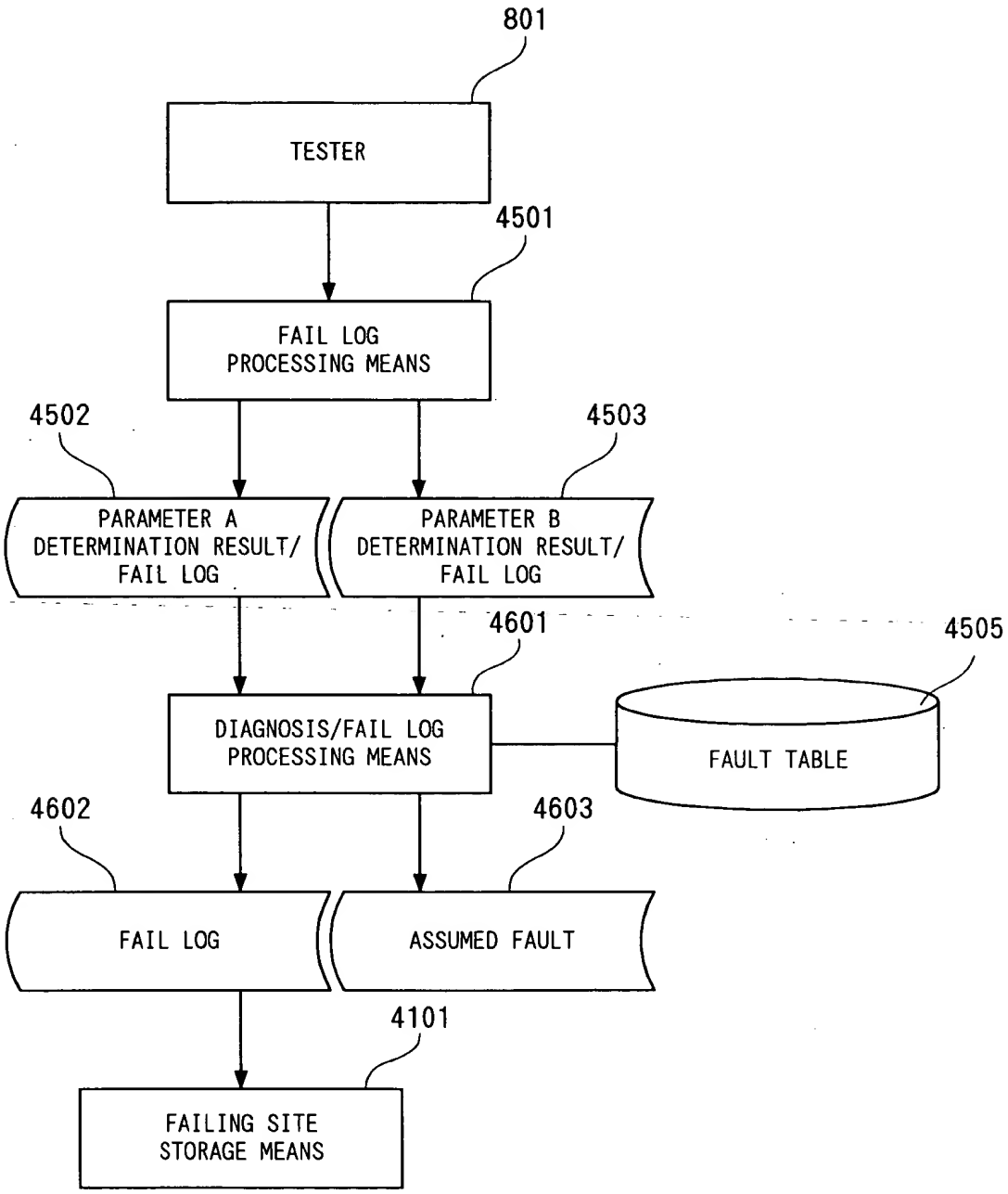

801
TESTER
4501
FAIL LOG
PROCESSING MEANS
4502
4503
PARAMETER A
DETERMINATION RESULT/
FAIL LOG
PARAMETER B
DETERMINATION RESULT/
FAIL LOG
4601
4505
DIAGNOSIS/FAIL LOG
PROCESSING MEANS
FAULT TABLE
4602
4603
FAIL LOG
ASSUMED FAULT
4101
FAILING SITE
STORAGE MEANS

FIG. 44

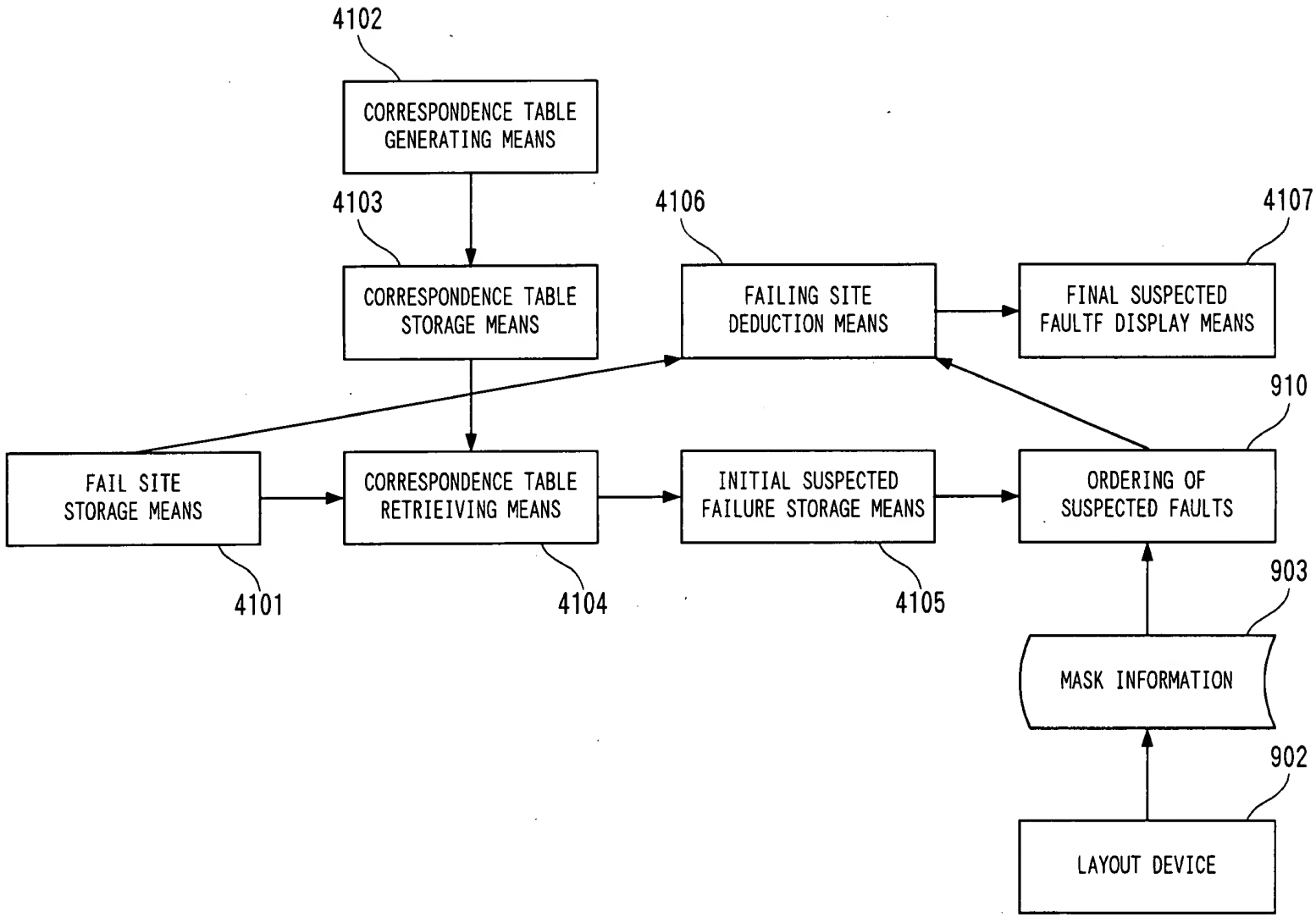

4102
CORRESPONDENCE TABLE GENERATING MEANS
4103
CORRESPONDENCE TABLE STORAGE MEANS
4106
FAILING SITE DEDUCTION MEANS
4107
FINAL SUSPECTED FAULTF DISPLAY MEANS
910
FAIL SITE STORAGE MEANS
CORRESPONDENCE TABLE RETRIEIVING MEANS
INITIAL SUSPECTED FAILURE STORAGE MEANS
ORDERING OF SUSPECTED FAULTS
4101
4104
4105
903
MASK INFORMATION
902
LAYOUT DEVICE

FIG. 45

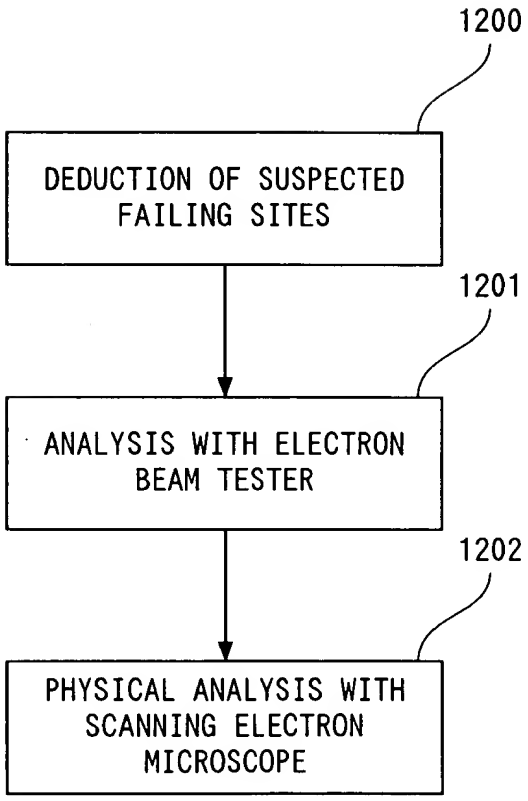

1200
DEDUCTION OF SUSPECTED FAILING SITES
1201
ANALYSIS WITH ELECTRON BEAM TESTER
1202
PHYSICAL ANALYSIS WITH SCANNING ELECTRON MICROSCOPE

FIG. 46

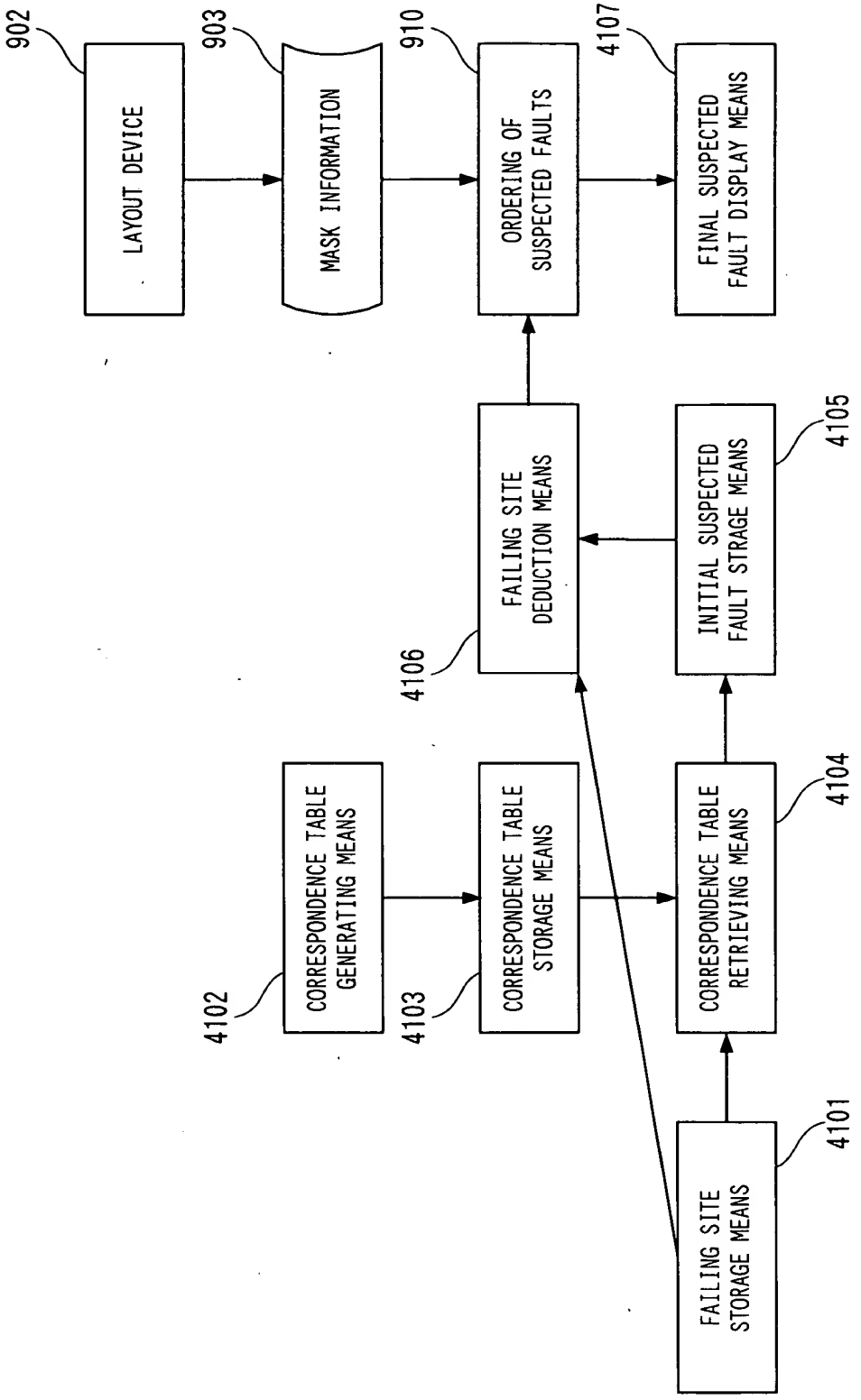

902
LAYOUT DEVICE
903
MASK INFORMATION
910
ORDERING OF SUSPECTED FAULTS
4107
FINAL SUSPECTED FAULT DISPLAY MEANS
4106
FAILING SITE DEDUCTION MEANS
4105
INITIAL SUSPECTED FAULT STRAGE MEANS
4102
CORRESPONDENCE TABLE GENERATING MEANS
4103
CORRESPONDENCE TABLE STORAGE MEANS
4104
CORRESPONDENCE TABLE RETRIEVING MEANS
4101
FAILING SITE STORAGE MEANS

FIG. 47

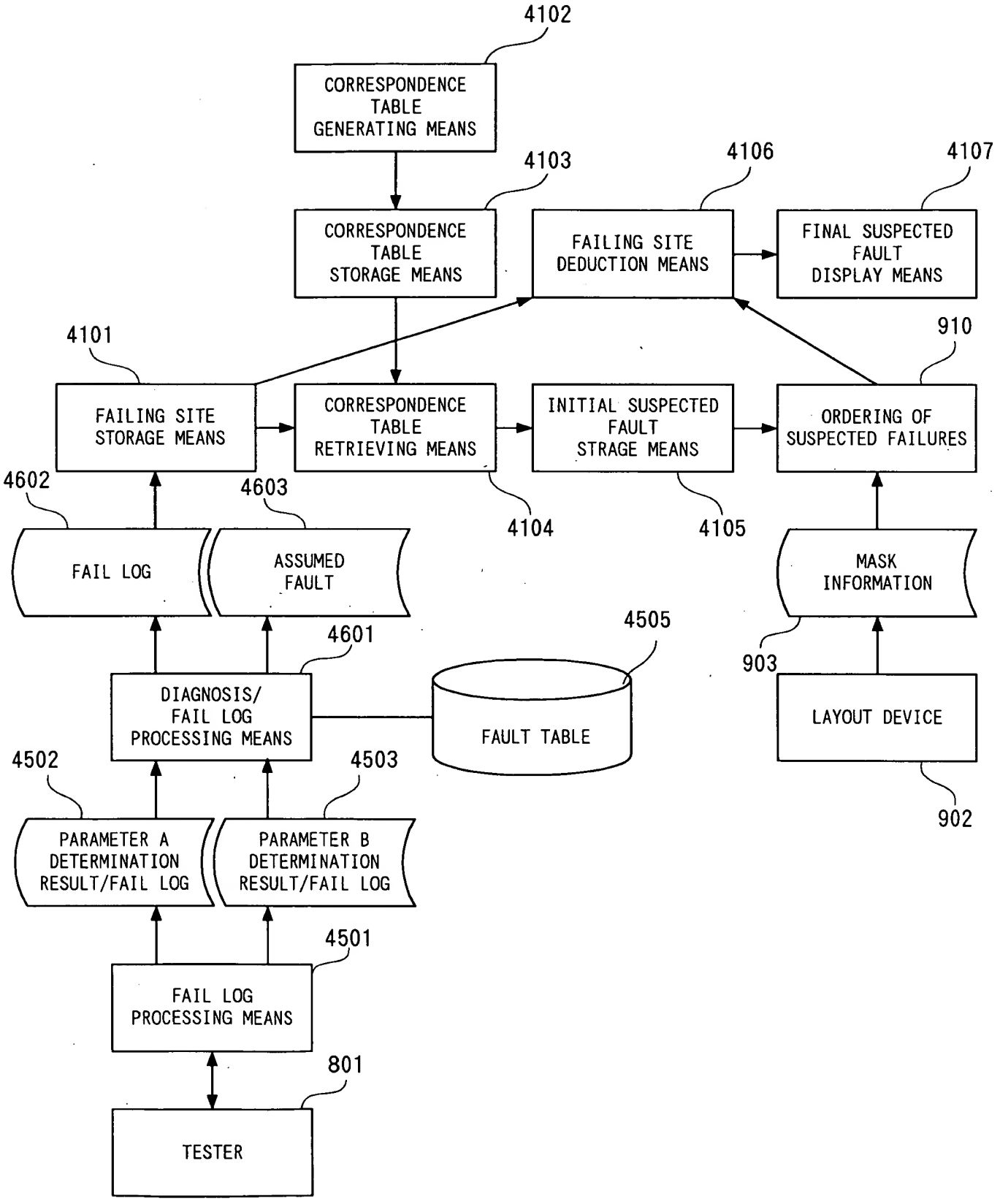

4102
CORRESPONDENCE TABLE GENERATING MEANS
4103
CORRESPONDENCE TABLE STORAGE MEANS
4106
FAILING SITE DEDUCTION MEANS
4107
FINAL SUSPECTED FAULT DISPLAY MEANS
4101
FAILING SITE STORAGE MEANS
CORRESPONDENCE TABLE RETRIEVING MEANS
INITIAL SUSPECTED FAULT STRAGE MEANS
910
ORDERING OF SUSPECTED FAILURES
4602
4603
4104
4105
FAIL LOG
ASSUMED FAULT
MASK INFORMATION
4505
4601
903
DIAGNOSIS/ FAIL LOG PROCESSING MEANS
FAULT TABLE
LAYOUT DEVICE
4502
4503
902
PARAMETER A DETERMINATION RESULT/FAIL LOG
PARAMETER B DETERMINATION RESULT/FAIL LOG
4501
FAIL LOG PROCESSING MEANS
801
TESTER

FIG. 48

PRIOR ART

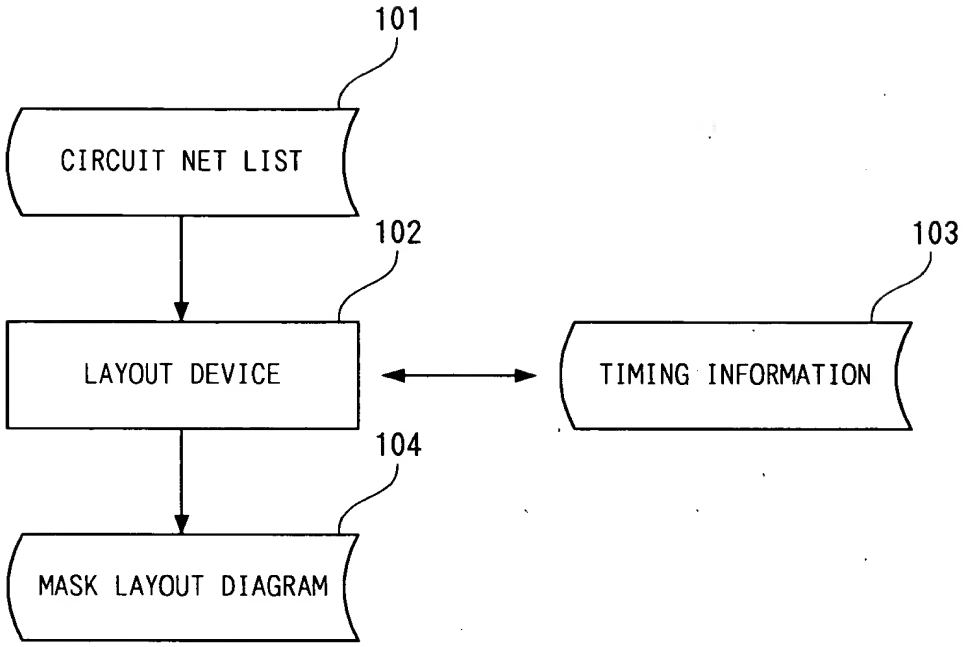


FIG. 49

PRIOR ART

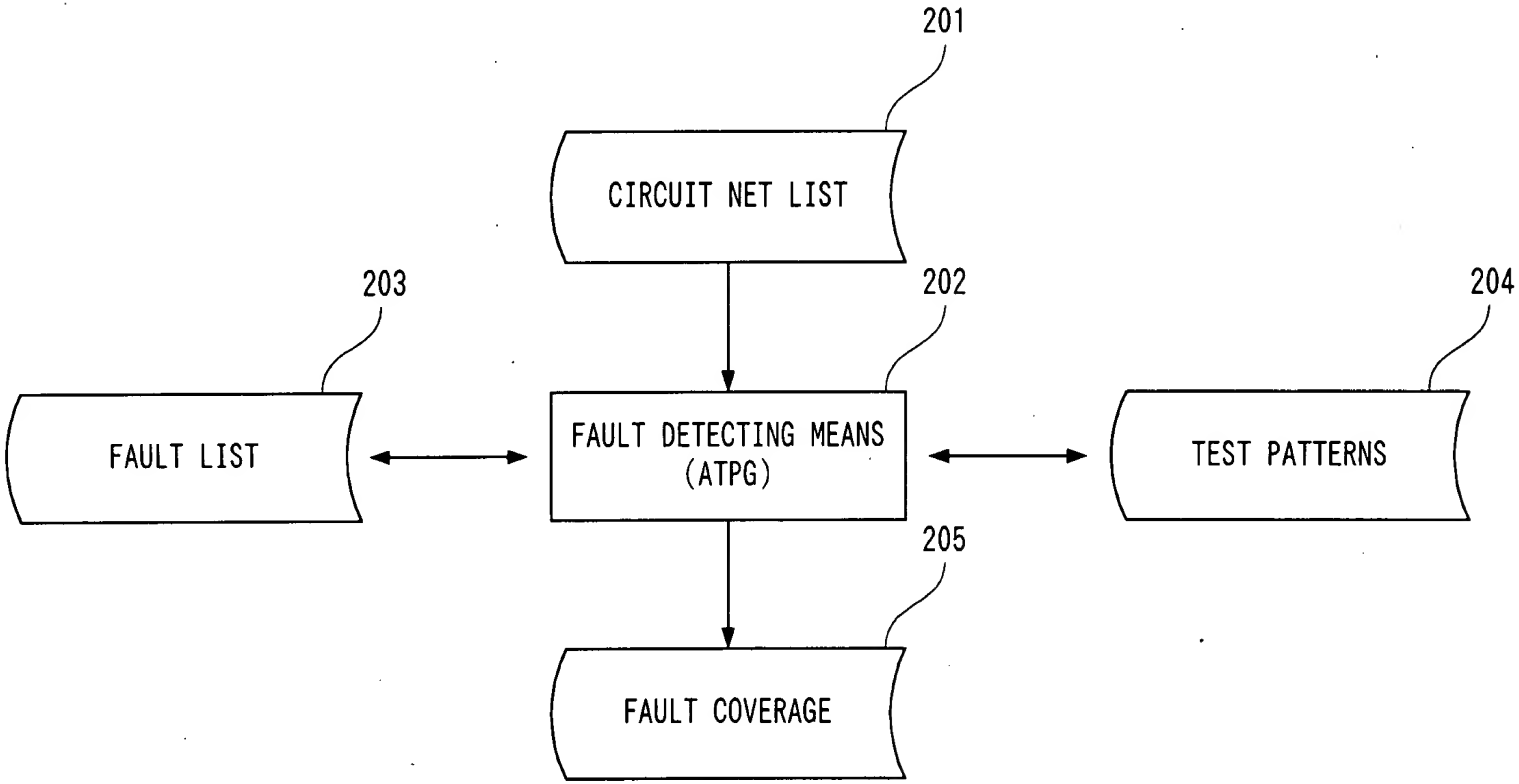
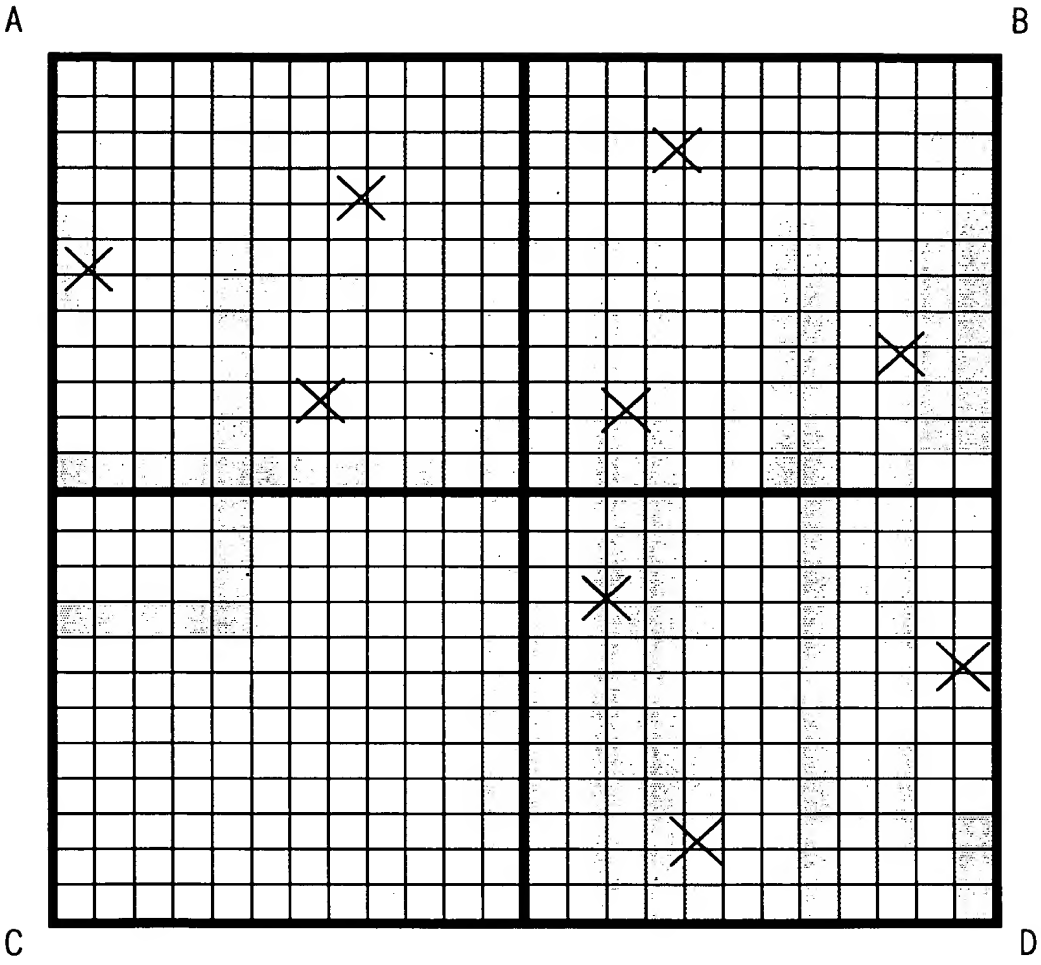


FIG. 50



PORTION WITH MASK

PORTION WITHOUT MASK

FAULT CAUSING SITE

MASK PRESENCE RATE

B>D>A>C